Bell Telephone

The Bell System's Part in Defending the Nation • F. R. KAPPEL

A Reasonable Rate Program • CHARLES E. WAMPLER

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Bell Telephone Magazine

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A Medium of Suggestion & a Record of Progress

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Cleo F. Craig, *President;* Carroll O. Bickelhaupt, *Sec.;* Donald R. Belcher, *Treas.*

Who's Who & What's What

in This Issue

THE BELL SYSTEM covers a lot of territory, and the man who undertakes to survey and report upon a System-wide activity finds he has quite a job on his hands. This is particularly true of the System's national defense activities, which ramify into just about every department of the business. F. R. KAPPEL is in a good position to observe this nation-wide effort in broad perspective, because since 1949 he has been the A. T. & T. Company's Vice President in charge of the Department of Operation and Engineering. Twenty-five years before that, he had started with the Northwestern Bell Telephone Company as a groundman, and in the next nine years had served in Plant, Engineering, and Commercial posts in the Minnesota Area, becoming equipment and building engineer in 1933. Three years as plant engineer in the Nebraska-South Dakota Area prepared him for his headquarters assignments in Omaha, beginning in 1937, where he was successively plant operations supervisor, assistant vice president, and Operating Vice President. He moved to New York and the A. T. & T. in 1949, and this proved to be a busy year for Mr. Kappel; for he was an assistant vice president in the Department of Operation and Engineering, and then Vice President in charge of the Long Lines Department, before he assumed his present responsibilities in November of that year.

NO END to the spiral of inflation is yet in sight, and it is CHARLES E. WAMPLER'S responsibility, as A. T. & T. Vice President in charge of Revenue Requirements Studies, to keep a sharp eye on its effect upon the Bell System. With the System since 1929, he had both Traffic and Engineering experience in the Illinois Bell Telephone Company before he became an assistant vice president in Chicago in 1948. The following year found him with A. T. & T. in New York, where, after serving for a period as assistant vice president in the Personnel Relations Department, he was made General Manager of the Long Lines Department. He was elected to his present

F. R. Kappel

Charles E. Wampler

Oliver E. Buckley

C. C. Duncan

Richmond B. Williams

position last July. Mr. Wampler's telephone career has had several interruptions. Twelve years ago, he took a year of graduate work at Massachusetts Institute of Technology. Two years later he went to Washington, D. C., to work with OPM and WPB. This was followed by a tour of Army duty, beginning in 1942, which included some months in France and Japan before he doffed his uniform in 1946 as a lieutenant colonel with a Legion of Merit award. Earlier this year he was on temporary assignment in Washington for several months with the Defense Production Administration.

CHAIRMAN of the Board of Directors of Bell Telephone Laboratories since April 20 of this year, DR. OLIVER E. BUCKLEY at that time accepted President Truman's appointment as Chairman of the Science Advisory Committee of the Office of Defense Mobilization. In World War II, in addition to defense activities as President of the Laboratories, he was a member of the Communications and Guided Missiles divisions of the National Defense Research Committee. He is also a member of the National Inventors' Council and of the General Advisory Committee of the Atomic Energy Commission. During the first World War, commissioned a Major in the Signal Corps, he had charge of the Research Section of that Service in Paris.

Dr. Buckley entered the Bell System in 1914 as a research physicist. In 1927 he became assistant director of research of the Laboratories, and was made director of research in 1933. He became executive vice president three years later, and was elected President of the Laboratories in 1940. He has contributed several articles to this MAGAZINE, including "Bell Laboratories in the War" in the Winter 1944–45 issue, and in the Spring 1950 issue "Some Observations on Industrial Research."

THE REQUIREMENTS of the nation's defense program have focussed attention on the need for conservation of metals and other scarce materials, and the Bell System is coöperating wholeheartedly in this conservation campaign. But conservation of materials in the Bell System is not confined to times of national emergency; it is, says C. C. DUNCAN, "the normal way of life." As supply practices engineer in the Plant Division of A. T. & T.'s Department of Operation and Engineering, Cliff Duncan is able to observe and develop many of conservation measures which are being

(*Continued on page 173*)

Salvaging copper for the Bell System's needs. The wire from the old line on Robert's Mountain, in Oregon, now replaced by cable, will be smelted down and re-used in the nation's telephone service. *See the article beginning on page 188*

Both Normal and Highly Specialized Operations Contribute Importantly to Civilian and Military Activities as the Country Continues in a State of Emergency

The Bell System's Part in Defending the Nation

F. R. Kappel

DOWN THROUGH THE AGES, means of communicating have been a major factor in the success of both offensive and defensive military operations as well as in civilian projects. Thus it is only natural that, ever since the telephone has become a part of everyday living, the Bell System has had a major role in both war and peace. It is traditional in the Bell System to be prepared for any emergency that might interrupt service. In keeping with this tradition, we are busily engaged in many special activities during the present defense effort.

There has been so little time since the end of World War II that it might seem reasonable to suppose that the procedures and arrangements developed for it could simply be dusted off and reapplied. All of these have been examined, but so many fundamental changes have occurred that the old ways are no longer wholly adequate.

The Regular Job

COMMUNICATIONS have always been essential to the manufacture and delivery of both civilian and military products. During the past several years the increase in complexity of these products, and particularly the tools of the fighting man, have complicated all the processes of fabrication, operation and servicing—with a consequent growth in the volume of communications as well as the need for speed.

The need for the Bell System to build substantial amounts of telephone plant, in order to meet the communication requirements of the nation, is much greater than it was at any time during or before World War II. The System is twice as large as it was then and is far more generally depended upon by all elements of the population for their daily work and their daily living.

The Bell System is meeting this challenge.

At the end of World War II, the Bell companies had a backlog of two million requests for service which had not been filled because facilities were lacking. The telephone plant was loaded more heavily than ever before. Since that time there have been continued high demands for additional telephone service.

To care for the backlog of held orders for service and meet this demand, the telephone companies have carried on continuously a large program of construction. Although this new construction and special measures to load the plant have made it possible to connect nearly 10 million additional main telephones, not all requests for service have been filled.

It had been expected that the held orders could be substantially cleared during 1951; but the upsurge of demand which began with the Korean crisis about the middle of 1950 has delayed that possibility, in spite of a construction program costing over one billion dollars this year. Limited copper supplies have prevented a greater amount of construction.

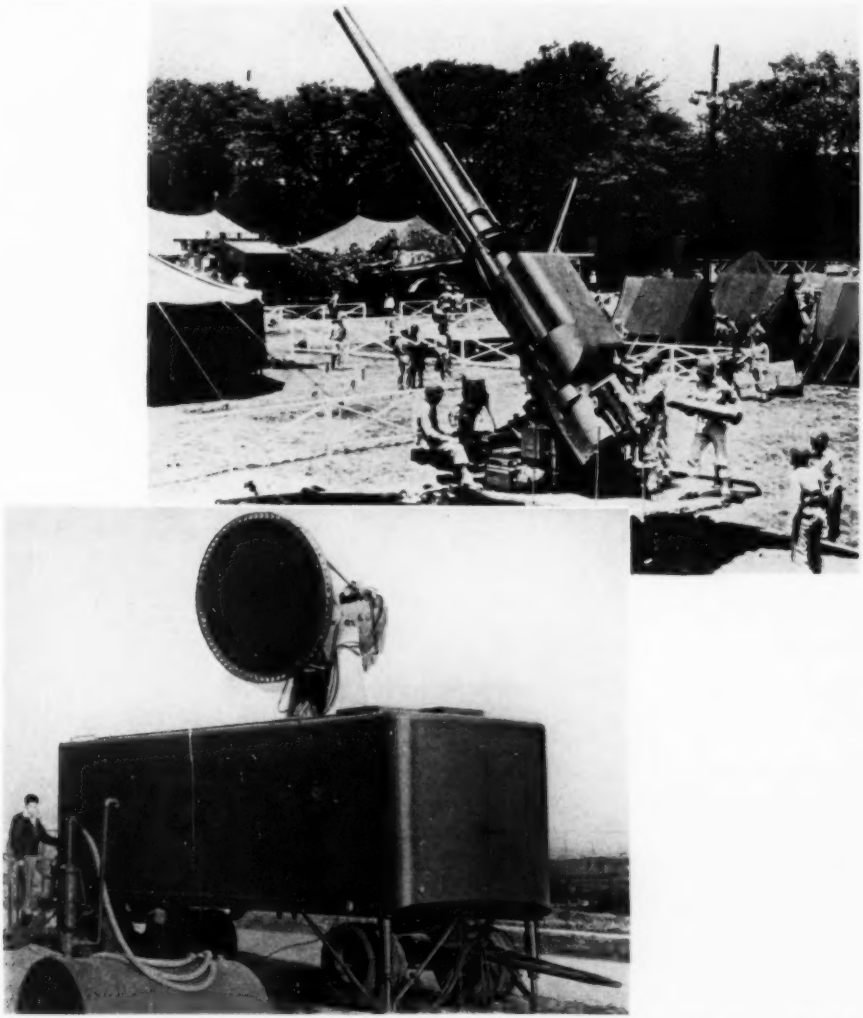
The growth of toll messages during and since World War II has been even more rapid than the growth of exchange service: an increase since the end of 1940 of 170 per cent. This has necessitated a great expansion and strengthening of the capacity of the toll plant. Since the Korean crisis, the rate of increase in toll messages is even more rapid than before, so that toll plant construction is being still further expanded. This service is particularly important for defense production, which relies heavily on fast toll service. Since the war, five and a half billion dollars of plant have been added to the five billion already in use—all of it now serving in this tremendous defense effort of ours.

Communications for the Armed Forces

EVERY BRANCH of the Armed Forces depends on the telephone night and day. New and re-activated military camps and bases need a vast amount of telephone service and need it quickly. The integration of the whole nation into an armed unit requires a spider-web network of private lines connecting all important locations both for administrative purposes and for controlling the airplanes and anti-aircraft batteries so vital to defense.

Naturally, such requirements take precedence over other work, and military and essential defense requirements are being fully met. Often, to meet the time elements in a particular case, it is necessary to take switchboards intended for civilian service, or to take existing long distance circuits away from the telephone message service, and to replace them by building new plant as soon as time and available material will permit.

The Camp Atterbury project is a good example of the kind of job being done for the Armed Forces. The Indiana Bell Telephone Company and the Western Electric Company completed a 1,000-line dial P.B.X., 35 positions of long distance switchboard, and coin-box facilities to serve the 30,000-man capacity camp in one-tenth of the time normally required



One result of Bell System teamwork—Laboratories development and Western Electric production, in this instance—is a new and highly effective fire control system for anti-aircraft artillery for the Armed Forces

for such a project. Twenty-nine days after the first notification, the dial P.B.X. was in service, and the rest of the job was ready in the next two days.

In Washington, the Chesapeake and Potomac Telephone Company and Western Electric added 1,000 lines of dial P.B.X. equipment to the Pentagon board in less than one-third of the time normally required for such a project.

The tag reading "National Defense Order" helps speed the installation of this extensive dial PBX system for an airplane factory

Weapons for the Armed Forces

ANOTHER PHASE of the System program of active coöperation with the Armed Forces on items of front-line consequence is the work of the scientists at the Bell Telephone Laboratories, whose efforts have been unremitting to create new and more effective devices for military use.

The story behind the $150,000,000 of Army Ordnance contracts for development and production of an anti-aircraft fire control system is representative of the close liaison which has existed between military organizations and the Bell Laboratories-Western Electric team. After the end of World War II, the Army Ordnance Corps asked the Bell System to undertake research, development, and manufacture of the fire-control system not only because of its wide experience with gun directors and radar of World War II but also because of its unique qualifications in the field of electronics and in the complex switching mechanisms which underlie the dial system of the modern telephone network.

The new fire-control system is an outgrowth —with a great many refinements—of the famous Bell Laboratories-Western Electric electronic gun director and its associated radar systems, which proved so remarkably effective against planes and "buzz-bombs" in World War II. This earlier fire-control system, a major "secret weapon" of the war, worked almost entirely automatically. Radar found and "tracked" a hostile plane or projectile, and fed continuous information concerning its location into a computer, which was the brain of the system. At the same time, data relating to wind velocity, muzzle velocity of the shells, temperature, and similar factors, were given to the computer. This machine then automatically calculated where the shell should explode to bring the plane down, and aimed the guns to do just that.

THE NEW fire-control system, adaptable to firing anti-aircraft batteries, operates on the same general principle as its predecessor, but many improvements have been incorporated. As a result, it is far more effective and

flexible than the World War II version. It is, of course, geared to handle high-altitude high-speed targets, and to take into account advances in plane and projectile performance which have been made in the last few years.

Another "special" undertaking is that of the management of the Atomic Energy Commission's Sandia Laboratory. The purpose of this Laboratory, now a major facility, is: "to bridge the gap between laboratory development work and the manufacturing operations on atomic weapons." Sandia is operated on a non-profit basis by a subsidiary company of Western Electric.

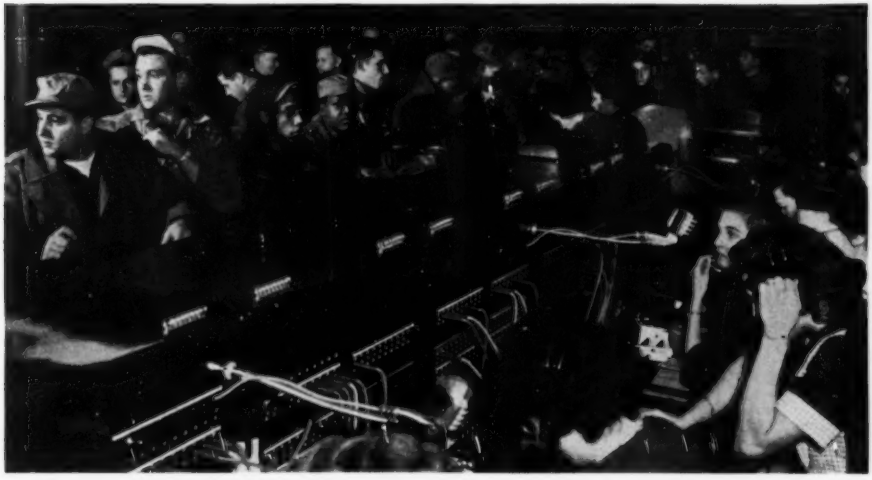
Sounding the Alarm

IN THE EARLY DAYS of the American Colonies, a lantern in "the old church tower" flashed the warning which Paul Revere carried on horseback to "every Middlesex village and farm" —perhaps a dozen miles. Adequate advance warning of an attack is infinitely more important now than it was then, and so today a tiny dot of light on a radar scope can start a chain of action that will alert the whole civilian population of the United States.

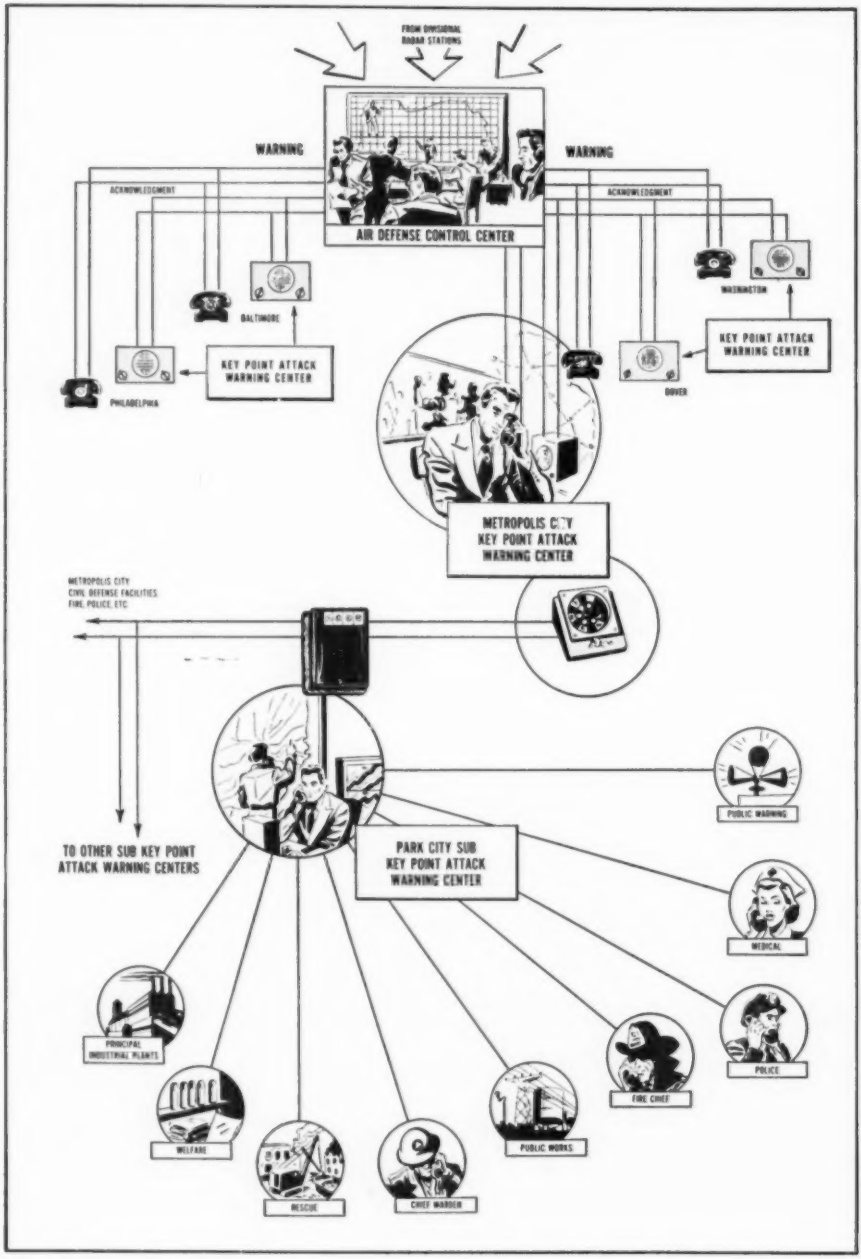
It took Paul Revere, on his horse, several hours to warn a few villages. Today it is possible to flash the warning to every city and town in the entire country and to sound the warning sirens in a matter of minutes.

World War II had its air-raid warning arrangements and attack warning systems, and these are with us again; but the simplicity of merely utilizing a chain of telephone calls has been outmoded by the increased speed of aircraft and the potentialities of guided missiles.

The Ground Observer Corps, the Filter Centers, and the Air Defense Control Centers—all dependent on telephone communication—have been re-established on substantially their



Operators at attended telephone locations at Army camps furnish a prized link with home and friends



This diagram illustrates how instant warning against enemy attack is transmitted by and is dependent on telephonic communication

former basis but covering a much greater part of the country. The addition of a large number of radar sites which require communications for transmitting the information shown on radar scopes has greatly increased the requirements for private-line circuits.

As during World War II, attack warnings would be passed from the Air Defense Control Centers (ADCC) to geographically selected cities of the nation (called Key Point cities) and to military establishments. From these cities the warnings would be further disseminated. The same basic layout was set up when the Air Defense Command started operations in 1949; however, the much greater speed of aircraft now requires time intervals, and consequently a telephone system, much different from before.

The Air Force wanted to be able to warn all the Key Point Cities throughout the nation within two minutes and to receive acknowledgments from all the key points on each network within five minutes. By establishing private-line networks with loudspeakers at each Key Point, the Bell System, together with the Independent telephone companies, has more than met this objective. Similar networks are used to warn the important military establishments. The original toll terminal arrangement, using regular service facilities, is still available as an alternative method in case of need.

Private-line signaling networks have also been adopted for the dissemination of warnings from the Key Points to other cities and to all necessary locations such as civil defense organizations, police and fire departments, factories, etc. At the request of the Federal Civil Defense Administration, and through the usual close coördination between the A. T. & T. Company, the Bell Laboratories, and Western Electric, a new system for almost instantly sending the warning signal to practically an unlimited number of points was designed and the first units manufactured within four months from the time an agreement on requirements was reached with the FCDA representatives.

THIS "Bell and Lights" system, as it is called, is actuated by a dial at the control point, where an operator

Civil Defense Report Centers such as this gather and pass along damage reports to Control Centers for evaluation and action

merely "dials the color" of the alert. At the warning station, the degree of alert is indicated both by lamps and a code-ringing bell. The system has a capacity for four degrees of alert—Yellow, Blue, Red, and White.

With this combination of private-line networks, it is possible for all desired points, from east to west and from north to south, to receive an attack warning within less than two minutes from the time the decision is reached at the Air Defense Control Center. The availability of the regular message telephone circuits, which in themselves are on various routes and well protected by telephone company diversification of facilities, as an alternative arrangement meets the need for back-up at very low cost.

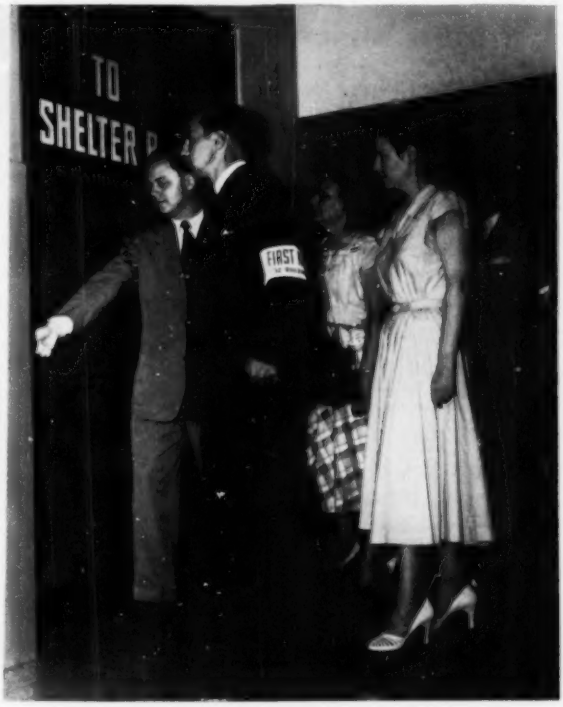
Civil Defense

IN ADDITION to providing the means already discussed for sending out an alarm, telephone companies are deeply involved in plans of the Civil Defense Organization. Nation-wide telephone and teletypewriter networks are required, and cities in target areas are establishing detailed plans for preventive measures and for relief and restoration after an attack. These plans involve the establishment of disaster control centers which must be able to talk to police, fire, hospital, utility, and other vital services for coördination and direction of relief work.

These communications requirements are substantial, and offer a number of special problems. The Bell System is working closely with

Checking employees' identity is a precaution against the entry of unauthorized persons into telephone buildings

Civil Defense authorities at all levels—national, state, and local—to meet these needs with the most suitable tools: signaling systems; wire, radio, mobile, or point-to-point communications, all of which the telephone companies now have available in almost all large centers. A telephone man is part of the staff of practically every civil defense organization.



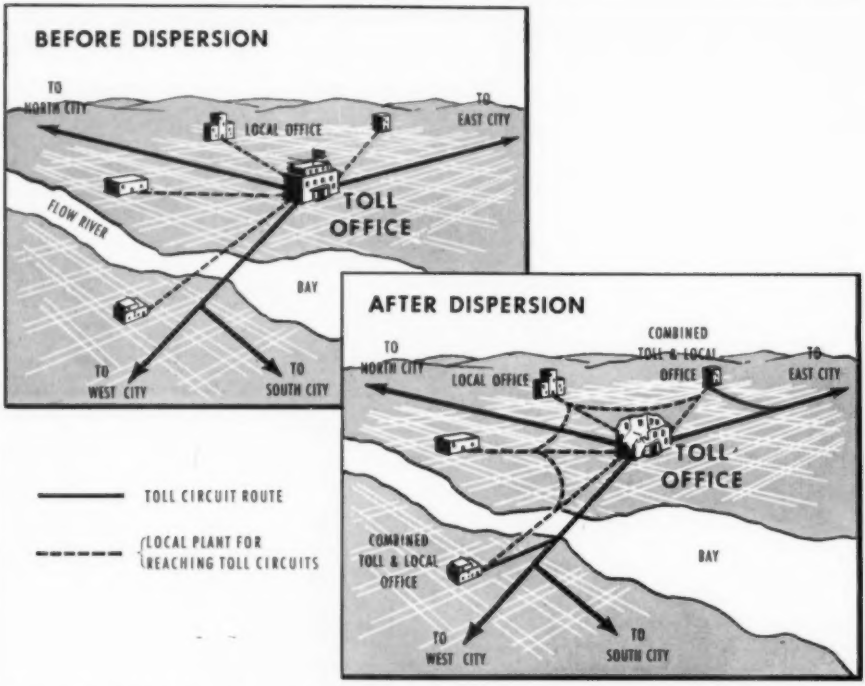
Shelters, drills, and first aid training are elements of protection for employees in telephone buildings

Continuity and Reliability of Service

IT IS ESSENTIAL to provide the service required, of course; but unless continuity is maintained and provision is made for prompt restoration of interrupted service, it cannot be said that the job has been done. Telephone companies face this problem constantly, and experience over the years has shown the necessity for building plant and arranging everyday operations to assure the maximum of service reliability.

The national toll network of the Bell System is widely dispersed over many routes and most of the large cities can be reached from several directions. Thus, if the normally used circuits are interrupted, alternative routes are immediately put in service and additional ones are readily available. As a matter of regular routine, strategically located traffic control bureaus are constantly informed regarding the condition of all major circuits. They are able to take action before serious delays occur.

Since World War II, coaxial cables having a capacity of many hundreds of channels, and radio relay systems with a potential capacity as great as or greater than the coaxial cable, have been installed on a large scale. Extensive use of these facilities has not only increased traffic-handling capacities but has provided diversification of routes and types of equipment. For example, seven separate transcontinental routes, employing all



Dispersion of telephone transmission facilities is an important factor in the ability to maintain continuity of service after enemy attack

modern types of facilities, provide a large measure of safety against serious interruptions to essential traffic. Another example is a radio-relay channel now being constructed from Boston to Philadelphia and Washington. It will follow a new route, completely by-passing New York City, and will thus make available a substantial number of direct circuits from Washington to the many important military and civilian installations in the New England states, no matter what might happen in New York City.

THOUGHTFUL attention is being given to means of avoiding even a temporary loss of all toll services in a large city, even in the event of complete destruction of the main toll centers. The general principle followed is to terminate a portion of the toll circuits in outlying buildings rather than in the main toll centers and to provide means of access to the local telephone offices in the city. The basic service for essential calls provided by these circuits would be supplemented rapidly by restoration measures.

The diversification of exchange plant is especially important to the communication services within each community. In this connection the vast network of cables (the principal

ones being underground) and the wide dispersion of switching centers make for a system that inherently provides continuity of service even though a part of it is destroyed. In addition, the telephone companies have in service mobile radiotelephone systems in 67 major cities, serving more than 10,000 telephones in automobiles, trucks, boats, and other mobile units. This system, integrated as it is with the wire system, is a strong element of protection for essential service in an emergency.

In addition to the safety afforded by wide dispersion of facilities, adequate protection must be provided for buildings and for the people who work in these buildings. For many years, the basic design of telephone buildings has been such that they afford good shelter under existing hazards. They are usually of steel or re-inforced concrete frames, and all construction has been aimed at making them as fire resistant as practicable.

Provision of fire protection devices, well trained personnel, and frequent fire drills are part of regular telephone planning. Under present conditions, additional measures are required. Programs are under way for establishing, training, and equipping teams of workers for first aid, air-raid warden, rescue corps, fire fighting, and other protection specialists. The best locations in the buildings are designated as shelter areas. Measures are being taken to prevent unauthorized access to buildings, and all practical means of reducing the possibilities of sabotage are being put into effect. Protection measures are continuously being studied, with the full coöperation of several Federal Government departments.

Restoration Plans

THE POSSIBILITY always exists that any telephone office or trunk route may be seriously damaged or destroyed and, even for coping with natural disasters, specific plans must be available for rapid restoration of service. These plans have been carefully reviewed and brought into

Outworn telephone equipment of every sort is salvaged in the Bell System's standard program of conserving all kinds of scarce materials

adjustment with the more serious conditions now facing us. The availability of mobile telephone service and over 100 strategically located emergency radio systems, which may be moved promptly to any location for service into a devastated area, both helps and speeds the execution of these plans.

Conservation of Materials

SOON AFTER the outbreak of hostilities in Korea, it became evident that the rapid build-up of the defense program would place unusual requirements on the supply of many critical materials. Steps were immediately taken by the Bell System to review its use of such materials and to see what measures might be taken to continue the programs already planned and still use as little of these materials as possible.

To date, measures have been instituted in the manufacture of telephone apparatus and equipment which on an annual basis will result in savings of the following magnitude:

Aluminum	15%
Copper	6%
Lead	15%
Nickel	30%
Rubber	15%
Tin	50%

Studies are continuing and additional savings will be introduced as they are found to be practicable.

In addition to the savings in equipment and apparatus design, development work has been speeded up on new types of carrier systems such as the "O" carrier which will be employed on open-wire lines and will be economical for much shorter distances than existing systems. The application of carrier to existing lines contributes very substantial savings in copper as compared to stringing additional wire. Everywhere, the plant is being loaded to the fullest extent practicable. Programs for the recovery of scrap are being actively pushed.* These and many other activities are all pointed toward doing the job with less.

Other Activities

ONLY A FEW of the many ways in which the Bell System is participating in defense activities can be even briefly described in one article. Many special projects cannot be discussed for security reasons. Still others are so important and so interesting that it would be impossible to do them justice in the space available here. The whole history can never be written; for it is made up of so many and such a variety of jobs, handled in all parts of the organization and so intermeshed with the daily routine, that many of them hardly show up except in the many extra hours of intense effort on the part of the entire team.

Teamwork

THE BELL SYSTEM TEAM—*design, manufacture, operation*—is functioning in high gear. Our job is a big one. We have the know-how, the personnel, and the leadership to meet the challenge—as we always have, with the best communication system in the world.

* See also page 188 & ff.

Increased Rates, to Assure Financial Health, Are Vital To the Bell System's Job of Meeting the Nation's Demand for Telephone Service

A Reasonable Rate Program

Charles E. Wampler

SUPPOSE somebody said this to you:

"Here's a rough outline of your job:

"First you will need to go out and get money for construction: you'll need enough to build telephone plant to the tune of about $4,000,000 per day until further notice.

"We want you to install about 1,000 new telephones every hour. Of course, this means putting in the cables, switchboards, and other equipment which go along with them. This will take a substantial part of the $4,000,000 a day.

"While you are doing that, remember we also need many more long distance lines. People are making more and more long distance calls, especially for production and defense. The lines are mighty crowded and all the new telephones that are going in will crowd them more than ever.

"Wherever there is a new or expanding defense plant getting into production, or a military training camp, or any project that is important to the country's security, we want you to get telephone service in *fast*.

"Also, you will need part of this money so that you can build more lines and switchboards to hook up radars, observation posts, airfields, civilian defense organizations, and the like. These arrangements should be of extra good quality and will have to have many special features. This is our first line of defense in case of enemy attack. In addition, we should have auxiliary switching centers, and alternative communication routes around and between key cities. Every minute that can be saved by having the best possible telephone setup may save countless lives.

"Always remember this:

"Even though you've added fifteen million telephones in the last six years, you still have a tremendous job to do. Hundreds of thousands of people are waiting for telephones. As their orders are filled, more people will apply for service. And, as you well know, nearly two million telephone users want a higher grade

of service than you can provide today because of crowded lines and switchboards. Only one way to fix them up: *keep on building.*

"Of course, we do have many more telephones today than a few years ago. We have better service, too. But we also rely on the telephone a great deal more than we used to. It's a basic tool and we can't do without it. The way this country lives and works is more dependent on the telephone than it ever was before. Any failure on your part to keep up with the country's telephone needs would simply mean that more people would be affected than at any time in the past.

"So we count on you to do this job. Otherwise the whole country will suffer—and that must not be allowed to happen."

What the Country Expects of Us

THIS, in a general way, is about what the country expects of the telephone company. It is a challenge which the telephone company will meet.

The Bell System has always been counted on to take the lead in advancing communications research and development, moreover, and we have a tremendous responsibility to keep them moving ahead. This is equally true of the manufacturing techniques we have acquired and are continually improving, which are immensely valuable to the country's defense.

For instance, in World War II, Bell Telephone Laboratories* and Western Electric, our research and manufacturing organizations, designed and produced more than half of the radar equipment used by the Armed Forces. Now the same team has created improved electronic gun directors, and controls for guided missiles. Together they are operating the Sandia, New Mexico, project for the Atomic Energy Commission. Other members of the Bell System team also give a helping hand in a variety of ways. Key people are made available from time to time to assist in national defense projects, whether the need be for craftsmen, engineers, or other special skills.

Such things are important *plus* values, over and above the basic job of furnishing telephone service and making it better. The main thing to remember is that in peace or war, or in organizing and preparing for defense, the country counts on us to keep our part of the communications business always moving forward on a broad front.

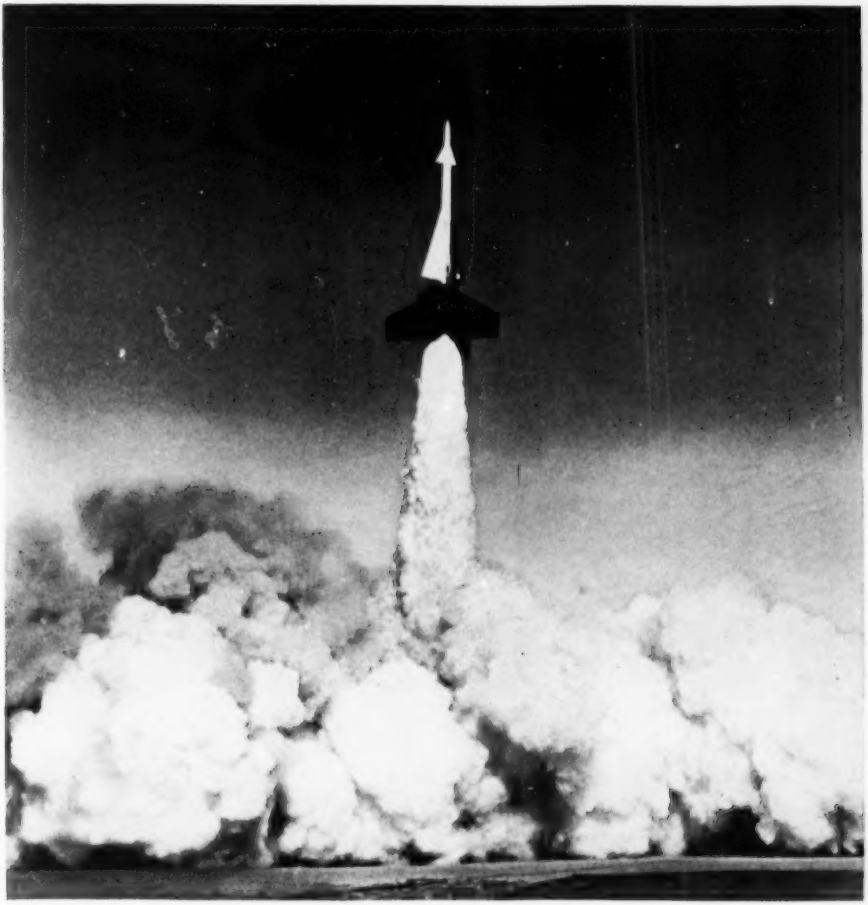
What I have said so far might be summarized in this way:

The Bell System has important work to do, now and for the future. Demands upon us are heavy. The nation's needs are great. What the System accomplishes in the months and years before us is of real consequence to everybody. This is serious business—and on a big scale.

Financial Problems of the Post-War Years

A BASIC INDUSTRY like ours simply has to measure up to its full responsibilities—including those extras which always mark a truly outstanding job. It must have able people on the job. It must use good, reliable equipment, and as much of it as is really needed.

* See also "Post-War Achievements of Bell Laboratories," beginning on page 163.



Electronic controls for guided missiles are an important development, by Bell Laboratories and Western Electric, carried out for the Armed Forces

To be able to do these things, it must be in first-class shape financially.

The two outstanding telephone facts of the post-war years seem to me to be these:

First, we have been faced with the greatest demand for telephone service in history. This tremendous demand is continuing.

Second, this has occurred during a time of continually increasing costs. Wages, supplies—all the day-to-day expenses—have kept going up. Telephone wage rates, for instance, have more than doubled since 1940. The investment needed for each new telephone has steadily increased. That was inevitable when wages and the prices of copper and lead and rubber and other heavily used materials

doubled and tripled. Taxes, too, have been increasing sharply. In short, it has cost more and more to put each telephone in, and also more and more to operate it.

To meet the demand and install the telephones, we have obtained well over four billion dollars from investors. And we raised this money at precisely the time when both the investment and operating costs were rising. Rate increases have not been sufficient to offset these higher costs, so that earnings have been inadequate. These low earnings, in turn, have meant that in obtaining new capital, we have not been able to get as much of it as we should through stock ownership. Under these circumstances, the greater part of all the new capital needed had to be borrowed. As a result, borrowed money today represents nearly half of all the System's capital, compared with less than a third at the end of 1945.

THE BELL SYSTEM has behind it a 75-year record of financial integrity. Such a record bolsters the confidence of investors that our historic financial strength will be maintained in spite of temporarily inadequate earnings. I

Providing adequate telephone facilities for military installations is a prime obligation upon the Bell System

Providing air raid warning systems throughout the country is a big undertaking

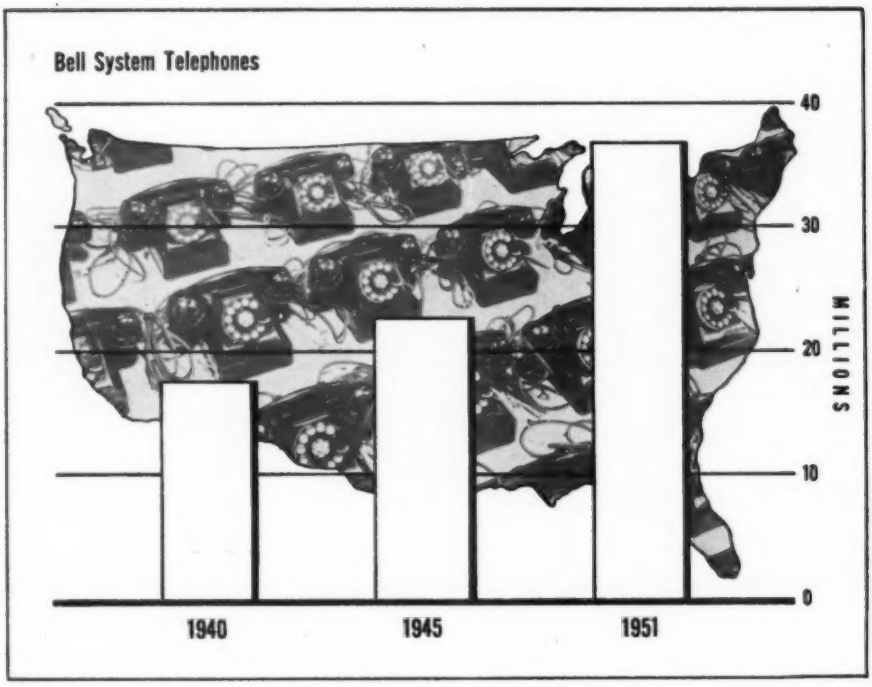
want to repeat, however, that in 1945, when we came to the end of the war and stood on the threshold of this great post-war expansion, the System's debt was less than one-third of total capital. That was what made it possible for the System to obtain the billions it needed in the next few years. That was what enabled us to borrow huge sums on reasonable terms; because our credit was first-rate, we could prudently increase our "mortgage" for the time being to meet the situation.

Now we are looking to the future —a future loaded with important and necessary work, calling for additional heavy construction and the investment of still more capital. We shall need more money from investors, in large amounts. We have already increased our debt. Experience has proved that the foundation of our ability to serve the public well is to keep our credit good. What, then, should be our future course?

We Must Obtain Stock Money and Pay Off Debt

To me, it is clear as sunlight that we need to attract investment by hundreds of thousands of people in A. T. & T. stock. We must plan to restrict our borrowing, to keep paying off on our mortgage. We need to get more

Postwar Growth Has Created Tremendous Bell System Need for More Capital



The number of Bell System telephones has more than doubled since 1940

people to buy into the business—or to increase their present ownership—instead of merely lending us their money. The decision of an investor to buy stock in a particular company is made in consideration of how much that company's earnings, dividends, and general prospects appeal to him when compared with other companies. In our case, it isn't a matter of making our situation and prospects attractive merely to a few investors. We must appeal to hundreds of thousands of new investors, as well as to the million stockholders we already have. Why so many? Because we need such tremendous sums of money to build new facilities and expand and improve the service.

These facts simply bring out that our "investor appeal," if I may call it that, must be excellent. But in recent years our income has not been adequate. Earnings on our capital have been low at a time when the earnings of the other industries with which we compete for investors' dollars have been high.

While other businesses have been hit by inflation as we have, they have

generally been able to offset their increased costs by prompt repricing of their products. This is in sharp contrast with the telephone business, for we are under public regulation—and the process of regulation takes time. Nevertheless, the basic fact remains that the remedy for us is the same as for any enterprise that finds its costs going up. There is no alternative to getting higher revenues, and that means higher telephone rates.

Increased Telephone Rates Are Reasonable

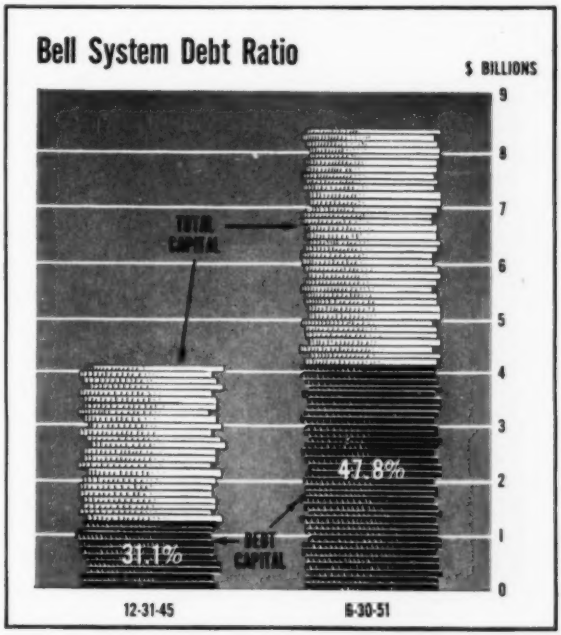
IT IS CLEAR that the rate programs of the Bell Companies are of real importance and significance to the country. Adequate rates bring good earnings, good earnings improve credit and attract capital, capital builds facilities to provide needed service. Adequate rates permit us to attract and hold competent people.

It is clear, too, that by any standard you can find, the Bell System rate program is reasonable.

For instance, Bell System intra-state rates have increased, on the average, only 24 per cent since 1940. If we include all the rate requests that are now under consideration, the average increase would still come to only about 40 per cent.

The official cost-of-living index * is now up more than 85 per cent over 1940. Food, clothing, housefurnishings, and so on—as you know from personal experience—have risen even more. The chart on page 161 brings out in a startling way how little telephone prices have risen compared with the prices of most other things.

Other standards of comparison also help to show how reasonable the telephone rate program is. For instance, because telephone wage rates have more than doubled in the last ten years, the operating expenses of the Bell Telephone Companies are higher by about $900,000,000 a year. This amount alone is nearly twice as much as all the increases that have been made in telephone rates.



The ratio of debt in the Bell System's capital structure, which was less than a third at the end of the war, is now nearly half

* Consumers' Price Index, U. S. Dept. of Labor.

Look at it from another angle: this time the angle of earnings. In 1940 the 30 large industrial companies included in the Dow-Jones Market Average earned an average of 9.7 per cent on their capital. The Bell System in the same year earned 7 per cent. Ten years later, in 1950, these 30 companies averaged 14.4 per cent earnings and the Bell System only 6 per cent. Please bear in mind that those 6 per cent earnings are the earnings of the enterprise which needs more capital from investors than any other company, and which must compete for investors' dollars with other well-managed companies that are currently earning more than twice as much.

Here is another striking fact. The average income per household—after taxes—was more than twice as much in 1950 as in 1940.* Compare that with the modest over-all increase in telephone rates. Telephone service is one of the greatest bargains in the household budget, and an even greater bargain than it was ten years ago.

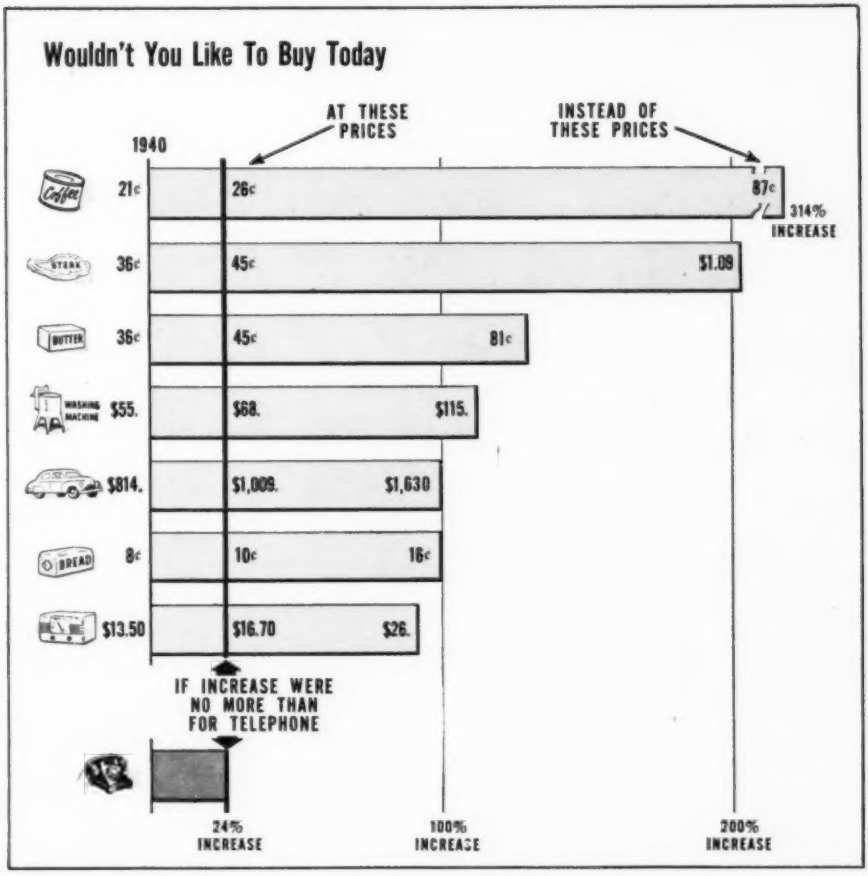
Telephone Progress Rests on Financial Good Health

SOME READERS may wonder why all the telephone rate increases that have been asked for can come to so much less than the general rise in prices and incomes.

The fact is that all during this time of inflation, great advances have been made in the techniques and methods of providing telephone service. These advances have offset some part of the rise in costs. They are a big reason why our rate increase program can be so reasonable—and why the cost to the telephone user comes to only a few cents a day. Actually, all the increases that have been made in telephone rates, plus those still needed to assure the Bell System's continuing finan-

Copper wire is only one of many items of telephone plant which have more than doubled in cost

* Federal Reserve System—Average Disposable Income.



The cost of telephone service is a much smaller part of the average household budget than it used to be. This chart shows what today's prices of various commodities would be if the increase were no more than for the telephone

cial strength, average out to hardly more than the cost of your daily newspaper.

I think you will agree that these telephone pennies buy a great deal. Just run over in your mind what the telephone means from day to day. Doing errands. Calling the doctor. Getting your business done. Linking you with friends and loved ones. A few additional cents a day buy the assurance that all these things will continue to be done for you, and done well.

They buy even more. For they assure continuance of the same progress that has given this country the best telephone service in the world, and that even now is reaching out to new horizons. Already, local calling areas are widening. Long distance operators are dialing millions of calls di-

Hundreds of thousands of Americans still look to the Bell System to put telephones into their homes

rectly to telephones in far distant places—completing calls over hundreds or thousands of miles within 30 seconds, sometimes even less. And there is much more to come.

You know the telephone as your servant in emergency. It is the nation's servant in emergency too. Nothing is more important to the nation's defense than a strong, sound telephone system. This strength, this soundness, rest on the rock of financial good health.

IF WE SUM UP, then, we see that

—all the rate increases granted and asked for are less than one-half the general rise in the cost of living

—telephone earnings are low when you compare them with the earnings of a great many other companies with which we must compete for capital

—telephone bills are a much smaller part of the average household budget than they used to be

—telephone rate increases have been only a little more than half of telephone wage increases alone, to say nothing of other rises in costs

—a few cents a day is a small price to assure the continuing capacity of the telephone to serve the people well.

THERE YOU HAVE IT. It's a straightforward story—a simple story—a story that anyone can understand. The fact that our requirements are so reasonable gives us full confidence that the public will support this rate increase program, which will insure that our country will continue to have the best telephone service in the world.

The Bell System's Research Organization Has Completed More Important Developments in the Past Six Years than In Any Like Period in Its History

Post-War Achievements of Bell Laboratories: I

Oliver E. Buckley

This is the first of two articles by the Chairman of the Board of the Laboratories. The second will appear in the Winter issue. EDITOR

THE RECENT WAR left in its wake a pent-up demand for service and a new set of world conditions under which that service must be furnished. It also speeded up many technological developments for which the ground work had been laid in the preceding decade. This combination of new needs to be satisfied and new art to meet them set the stage for an impressive output of new communication systems.

This amounts to saying that the period since the war has been one of golden opportunity for technical progress. What follows is a story of how this opportunity was seized and what came out of it.

The record is impressive. A larger number of important developments were completed than in any other six years of Bell Laboratories' history. The fact that the season was right for such a crop need not lessen our pride in it; for institutions, like men, only make the most of opportunities when they have prepared themselves to do so. The knowledge of materials, of electronics, of circuits and waves which was built into these new systems was the product of years of persistent study and experiment. In the last analysis, therefore, what has been accomplished since the war must be credited to the long-standing Bell System program of communication research.

A single example will serve to illustrate what I have in mind. Waveguides—that is, hollow pipes for carrying electric waves—have found their first peacetime use for communication purposes in radio relay. The study of waveguides at the Labora-

tories, however, goes back nearly 20 years to a time when an adequate means of generating microwaves did not exist, and when it would have taken a pipe hundreds of feet in diameter to transmit any signal which was being used commercially for communication.

The things we do at the Laboratories today always have such roots in the past. In the same way, the roots for our future accomplishments must already be growing.

In this article it is possible to mention only a few of the things accomplished, and these briefly. The smaller day-to-day jobs upon which we spend a large part of our time, and which play such an important role in keeping the System constantly modern and efficient, will not be mentioned at all. Even some of the more newsworthy developments have been omitted: among them telephone circuits over power lines in rural areas, packaged dial offices for use in small communities, private communication facilities for the civil airways authorities, modern equipment for switching telegraph circuits, and classroom hook-ups for shut-in school children. And the scientific research upon which our future hopes depend will scarcely be touched upon.

Even with these omissions, a fair impression should emerge as to the magnitude and variety of the work upon which the Laboratories has been engaged, and the measure of success it has attained.

A New Telephone

THE TELEPHONE which is now most familiar to the public was first manufactured in 1937. It was then the best telephone in the world, and has retained that position of leadership for many years. However, research through the years has brought new materials, new knowledge, and new manufacturing processes. A new telephone has been designed to take advantage of these advances, and to keep abreast of changes in public taste.

It is different in substantially every detail.

In appearance, it conforms to modern ideas of pleasing design. The handset is lighter, and its shape is better adapted to the average customer's head. The letters are placed outside the dial, where they are visible when the finger wheel is in motion. The bell has a more pleasing sound, and its loudness is adjustable. All these are features which add to the customer's convenience.

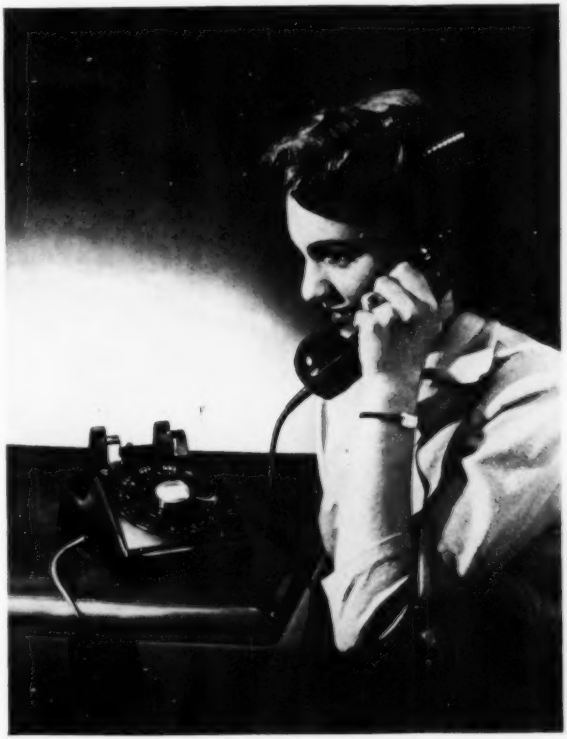
PERFORMANCE has also been greatly improved.

The transmitter delivers three times as much electrical energy for a given sound input, and the receiver recovers three times as much sound from the electrical signal which it receives. This gives a better volume of speech to subscribers far away from the central office, and permits the use of finer wire on the lines of those who are nearer. An ingenious device is provided to adjust the loudness automatically to the optimum level regardless of the distance to the central office. The naturalness of the speech is improved by reproducing more overtones than before. Loud clicks are automatically suppressed. The dial operates more uniformly and can be used at greater distances from the central office.

Many features have been intro-

duced to simplify manufacture, reduce the need for maintenance, and make installation easier.

For example, all components — including the dial—are mounted so as to be readily accessible when the cover is removed. The set is so designed that most variations in service requirements can be met by moving a wire from one terminal to another, or by some equally simple procedure which the installer can carry out on the job, instead of providing several kinds of sets differing in minor details to meet different needs. This not only concentrates manufacture on a smaller number of types; it also makes it easier for the Operating Companies of the Bell System to maintain a stock of telephones suited to their needs.



The latest telephone instrument designed for the Bell System is modern in appearance and has improved transmission characteristics

Carrier Systems for Short Wire Circuits

CARRIER SYSTEMS provide the means by which several conversations may take place simultaneously over the same pair of wires. They have played an important role in bringing the cost of telephone service over long distances down to its present low level. They are used on open wire, on cable, and on radio.*

In the past, it has not been economical to use them on short wire circuits. The reason is that carrier systems require special equipment at the ends of the line and at intervals along it, and on the shorter lines this equipment costs more than extra pairs of wires. The break-even point, in the case of cable circuits, has until recently been at 75 to 100 miles.

There are, however, several respects in which short wire circuits place less severe requirements on the carrier equipment than long ones, so that a system can be made somewhat

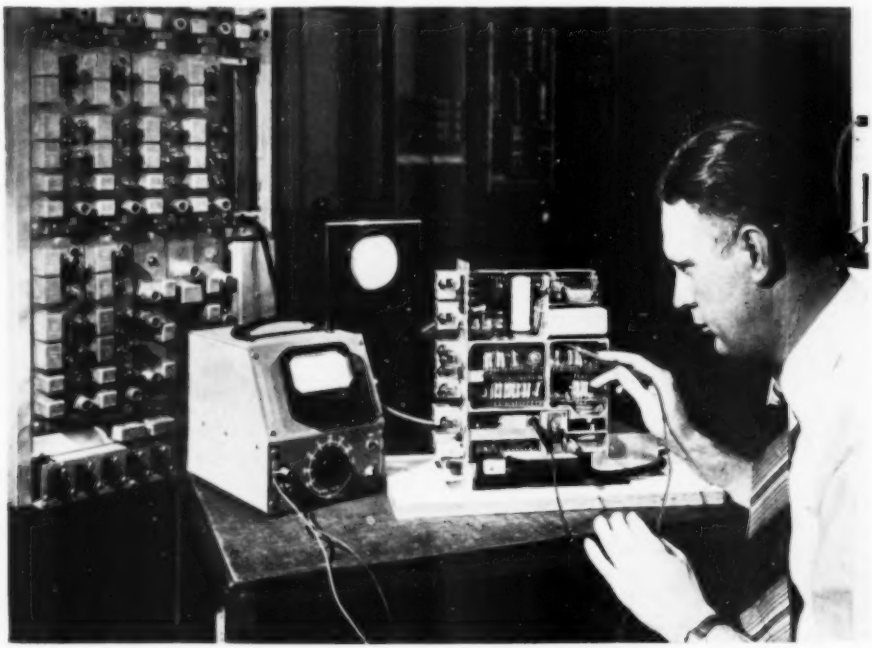
* See "Carrier Is King," MAGAZINE, Winter 1949–50.

less costly by designing it *only* for short-haul use.

By taking advantage of these relaxed requirements, and by exploiting the possibilities of new materials and new ideas of design, a system has been developed which costs less than extra cable pairs at distances as short as 15 or 20 miles. It will not replace the older systems on very long routes, but it fully meets Bell System standards of transmission on circuits up to 200 miles in length. These standards permit three or four such circuits to be connected together to provide a conversation path.

The system has many novel features. A device called a compandor confines the speech currents on the lines within narrower limits than the sounds which produce them, but at the distant end restores the full range of sound volumes. The currents which convey the stronger sounds thus cause less interference in adjacent circuits, and the weaker sounds are less affected by circuit noise. New circuit components—especially some which have resulted from the Laboratories' research on semi-conductors—are used in many places where vacuum tubes would otherwise be required, with a consequent reduction in size and cost, and also in the amount of power used.

Special care and much ingenuity have been exercised to keep the equipment compact. Maintenance has been made simpler by mounting whole circuits as plug-in units, so that when a



A recently developed carrier telephone system, compact and efficient, brings the advantages of carrier telephony to telephone circuits used over relatively short distances

unit needs attention it can be replaced by a spare as easily as vacuum tubes are interchanged. The compactness of the apparatus has facilitated this type of mounting. Although low cost has been a major consideration, it has not been achieved by sacrificing quality or adaptability.

The system provides 12 two-way circuits on two pairs of wires, and includes every feature which is needed to handle calls dialed by either customers or operators. Moreover, both pairs can be in the same cable, which is not usually the case with the older systems.

Thus it will be possible to provide for the rapidly increasing volume of toll traffic by increasing the capacity of cables already in place, instead of adding new ones. This will be of special value in conserving copper during the present emergency.

Coaxial cable currently being installed contains eight coaxial pipes, together with their supervisory wire circuits, and can carry many hundreds of telephone conversations or several television programs

Broad Band Coaxial Systems

A COAXIAL LINE is a small pipe with a wire running through the middle. Telephone currents travel along such conductors in essentially the same way as along a more conventional pair of wires. But because one conductor (in the form of a pipe) completely surrounds the other conductor (in the form of a wire), the currents are shielded against electrical disturbances from without that would affect transmission over ordinary wires, especially at very high frequencies.

The Laboratories began to investigate the properties of coaxial lines many years ago, as a part of its established policy of exploring new things. Theoretical study indicated that very broad bands of frequencies could be transmitted over them and used to provide large groups of telephone channels at low cost. The development of a system to transmit a band

of frequencies about 3,000,000 cycles wide was therefore undertaken, and also of terminal equipment to subdivide the band into as many as 480 telephone channels.

During the late '30s, the Laboratories conducted a successful field trial of this system over a circuit between New York and Philadelphia; and, just as the war began, this circuit, and another that had been built between Minneapolis and Stevens Point, Wisconsin, were put into commercial service. At this point the program was interrupted by the war.

WHEN the war ended, development was resumed, and has proceeded along two lines.

In the first place, the pre-war system has been modified and improved. Some changes were made to correct weaknesses in the original design; others were necessary to adapt it to television; 120 more telephone channels were added. These changes, most of which have now been incorporated in substantially all of the coaxial in service, make it possible to carry as many as 600 conversations over a pair of pipes, one for each direction, or to send a television program to any required distance over a single pipe.

In the second place, development of an entirely new system was begun, and has already made substantial progress. This system, when completed, will transmit a band of frequencies more than twice as wide as the present one. Such a system could be used in many ways. It could carry as many as 1,800 conversations, or it could provide a medium for transmitting television with more detail than at present, if in the future this should become necessary for some such purpose as the distribution to theaters; or it could be put to other uses.

Both systems operate over the same kind of pipes, and the new one is being so arranged that an existing system can be converted by changing the repeaters and inserting others midway between them. Such conversion will be economically feasible, since the cost of repeaters is small in comparison with that of the pipes.

The repeaters perform the same functions in these systems as in others: they correct the changes in shape which occur as the signals travel along the pipes, and restore them to their original strength. However, because of the broad band of frequencies that must be handled, this must be done more frequently and with greater precision. For the most part, repeaters are at unattended locations, in manholes or small outdoor huts, and great care is taken to avoid interruption of service.

FOR added safety, a spare pipe is usually held in readiness, and at suitable intervals along the line the repeaters are arranged to transfer the load instantly from the working line to the spare if serious trouble develops on any section of the line. The personnel at attended stations receive alarms when difficulties arise anywhere on the section of the line which is in their care, together with exact information as to the nature of many of them. Means are also provided for transferring the load to the spare conductor by remote control, adjusting the power level, or carrying out many other necessary operations.

There are now over 50,000 miles of coaxial pipes in the Bell System

Amplifiers for the Key West–Havana submarine telephone cable are built in such form that they can be enclosed in slightly enlarged sections of the cable itself. In this picture a Laboratories engineer and two assistants are removing a finished amplifier from the assembly fixture

plant. They represent an important addition to the nation's facilities for telephone and television service, and their potential contribution, through conversion to the new system which is under development, will be even greater.

Deep-Sea Amplifiers in a Submarine Cable

THE LAST SPLICE in new twin cables between Key West and Havana was made in April 1950, following a development program begun about 20 years ago, and established another milestone in communication.*

The cables are about 140 miles long. Each is equipped with repeaters at 40-mile intervals, and is used for transmission in one direction only. Together they provide 24 high grade two-way telephone circuits.

This cable had to be manufactured to much more precise dimensions than those built previously, in order not to affect adversely the repeater performance. This required special machinery, including "electric eye" control of the insulation diameter.

It is the repeaters, however, which represent the greatest break with tradition. They are different in almost every respect from anything seen heretofore. They use specially designed electron tubes which, we have reason to believe, will last for 20

* See "New Voiceways Under the Gulf Stream," MAGAZINE, Summer 1950.

years at least. These circuit elements are housed in a flexible tube about seven feet long and only slightly larger than the cable itself.

The design of such a housing, flexible enough to pass through the cable-laying machinery and strong enough to protect the delicate apparatus within it at depths as great as two miles, where the water pressure amounts to two tons per square inch, and tight enough to keep water from seeping in even under these enormous pressures, was a major problem in mechanical design.

Power for operating the repeaters is supplied over the cable conductors from the shore.

After a period of careful testing, the twin cables were opened to regular commercial service in the latter part of June, 1950. All channels met their test requirements satisfactorily and the performance of the system has been wholly up to expectations.

Radio Relay Systems

SINCE AUGUST 17 of this year, radio relay, the newest method of telephone transmission, has linked the Atlantic and Pacific coasts.* Used first to carry telephone conversations, this transcontinental radio relay system began transmitting television images last September; for the very broad frequency band which is divided into many voice circuits can also be used to transmit television. The same terminal equipment which is used with coaxial systems is being used for this purpose.

Radio relay is characterized by the use of radio waves so short that they possess many of the properties of light. Such waves can be focussed into narrow beams, much as a searchlight focusses light, so that a greater proportion of the energy sent out reaches its desired destination, and very little goes to places outside the beam where it might interfere with other radio systems. But, like light, such beams require an unobstructed path. Hence, the message is sent through a succession of relay points, spaced 25 to 30 miles apart and so located as to have unobstructed paths between them. At each of these points it is amplified, and is beamed out again toward the next relay point.

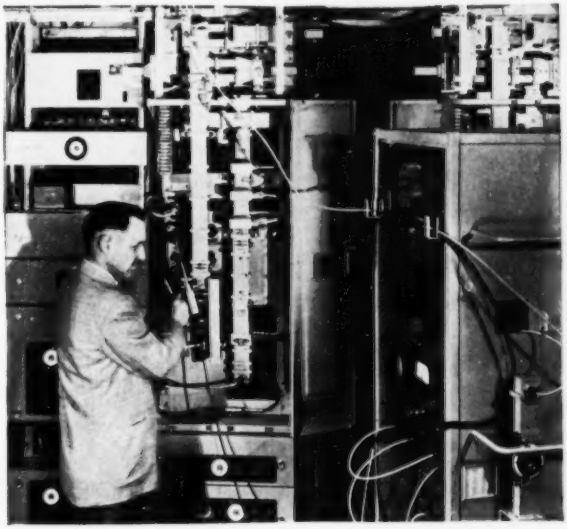
The advantages which would accrue from a radio system which passed the message along from repeater to repeater—just as is done in line telephony—were recognized many years ago. It was also understood that they could best be exploited by using very short waves. But vacuum tubes which would amplify such short waves, antennas to focus them in narrow beams, and circuit components to perform many other necessary functions were all lacking.

Many of the necessary circuit components became available in the late 1930s, largely as a result of a fundamental study by the Laboratories of the propagation of radio waves through hollow pipes. This study also led somewhat later to the invention of structures which focus radio waves exactly as glass lenses focus light, thus making it possible to design very efficient antennas. With these tools to work with, the development of a commercial system became possible. The first system was demonstrated on November 13, 1947, between New York and Boston, and

* See pages 175–187.

was studied intensively until it went into commercial service on May 1, 1948.

While this New York–Boston system was under study, a more advanced design was worked out; and it has been used in all subsequent installations. It incorporates many refinements. Some of these grew out of experience with the Boston system. Some are products of research which became available while the Boston tests were in progress. Among the latter, a better antenna and a better vacuum tube * were especially important.



An engineer adjusts microwave radio relay equipment

Linking New York and San Francisco are more than 100 relay stations. At each of these are two pairs of antennas, one pair pointed toward the next station to the east, and one toward the next station to the west. One antenna of each pair is used to receive incoming waves, the other to send waves forward. Each antenna, however, is capable of receiving or sending six different broad band channels simultaneously. A fully equipped route, therefore, could accommodate thousands of conversations simultaneously; or it could carry six television programs in each direction.

Only a few of these relay stations have attendants on duty. Special care must therefore be taken to assure service reliability. There are standby power plants to take over if commercial power fails. There are also special circuits over which alarms are sounded at some place, such as a nearby telephone office, where a maintenance man is on duty at all times, and over which coded signals are sent to him to tell the character of the trouble which has developed.

One of the six possible channels is to be held as a standby, ready to take over if serious trouble occurs. At present, the load must be switched to this channel manually at some relay point where attendants are on duty; but arrangements are now being developed to make the substitution automatic, even at unattended points.

As a complement to this long-haul design, a simpler one has also been worked out for use over short distances. It serves two purposes: to pick up television programs and carry them to the nearest point on a backbone route; or to provide short-haul

* See "Spanning the Continent by Radio Relay," MAGAZINE, Winter 1950–51.

extensions from backbone television routes to nearby cities.

By the end of this year, about 25,000 broad band channel miles of radio relay will have taken its place alongside of the 50,000 miles of coaxial pipes that are now in place. Together, they will increase substantially the telephone facilitities along the nation's backbone routes, and will go far toward a nation-wide distribution system for television programs.

The two systems—coaxial and radio relay—fill similar needs, and to a large extent can be used interchangeably. This was illustrated recently when a coaxial line was cut in two by a farmer's plough, and its load was transferred to the standby channel of a nearby radio relay, while repairs were made. Both systems, however, have their special points of excellence, and also their peculiar hazards. Radio could not be interrupted by a plough; but, as everyone knows who has listened to short-wave programs from abroad, atmospheric conditions cause the signal strength to fluctuate, occasionally fading almost to the point of extinction.

Of course, over the short radio relay jumps, the fading is not nearly so bad, and the system is designed to compensate for it over very wide limits. To determine how much fading should be expected, Laboratories' engineers, with the assistance of the Operating Companies, spent several years collecting data in many parts of the country, at various seasons,

An attendant secures a telephone connection for a passenger on a train in motion

and at various times of the day. From these, and from the extensive records which have been kept at some of our own locations for many years, the behavior of the proposed system could be predicted. The performance of the system to date has been in line with these forecasts, and generally satisfactory.

Other Developments in Radio

SEVERAL OTHER important radio developments have been completed since the war.

One is a new transmitter and receiver for overseas use. It is a successor to a design which has been in satisfactory operation for more than 15 years. The new transmitter will radiate twice as much power as its predecessor, and will carry four telephone conversations simultaneously, whereas the capacity of the other was limited to three. Both the transmitter and receiver occupy much less space than formerly. The transmitter is equipped with pushbutton tuning for all of its working frequencies, whereas the older equipment had to be tuned manually; arrangements are also provided for tuning it by remote control if desired.

Radio equipment was also designed to enable persons in automobiles or on moving trains to call any telephone that can be reached through other Bell System facilities and, conversely, to permit a particular automobile or a particular train to be called when wanted. This service has been so successful that the frequencies allotted for the purpose by the Federal Communications Commission are already overcrowded and additional allocations are urgently needed.

The equipment developed for these purposes is finding other uses. It is already providing trunk circuits in some special situations where open wire or cable would be difficult to construct. Such radio trunk circuits have also been installed to supplement and protect open-wire circuits on some routes which are subject to heavy sleet conditions.

Who's Who & What's What

(*Continued from page 139*)

used throughout the Bell System. He started with the Long Lines Department as a technical employee in St. Louis in 1927, and by 1939 had become district plant superintendent in Dallas. In 1946 he was appointed division construction coördinator in St. Louis, and later that year he became division plant superintendent. Early in 1950 he moved to New York as general plant supervisor, and later in the year was appointed Assistant to the General Manager. In this post he handled interdepartmental matters, including the coördination of defense activities affecting Long Lines operations. He transferred to his present position in February of this year.

ORIGINAL RESEARCH of the sort which RICHMOND B. WILLIAMS' article exemplifies is likely to foster pleasant contacts as well as to unearth significant facts, and he was so fortunate as to enlist both the interest and the assistance of officials of the Upstate Telephone Corporation of New York, in Johnstown, N. Y. Mr. J. E. Welles, public relations supervisor of that company, was particularly helpful; and since that is also the author's position in the Long Lines Department of the A. T. & T. Company, they obviously had a common

(*Continued on page 204*)

Trained, Equipped, and Ready

The most disastrous flood in the nation's history struck parts of the Mid-West last July. Damage was incalculable, and telephone plant and equipment—and people—suffered with the rest. The following report, given on the Telephone Hour radio program at the time, is indicative of the spirit in which telephone employees met the challenge. EDITOR

IT WAS RESTFUL in California where Juanita Bowen, an Ottawa, Kansas, telephone operator, was enjoying her vacation. But rest and relaxation were forgotten when she read about the floods back home. She knew there would be work to do. She cut short her holiday and hurried home to help.

In Salina, Kansas, an appeal was broadcast for at least five former telephone operators to come in and help handle emergency calls. Within 30 minutes, ten women had reported for duty and were on the job.

These are but two of the hundreds of stories of devotion to duty by telephone people in the Kansas-Missouri-Oklahoma floods. They are typical of the spirit of telephone people who fought to maintain service in the emergency, and who are fighting now to restore the service washed out by the angry waters.

I'd like to tell you about Henry Sparks, installer-repairman in Solomon, Kansas. Only two telephones in his town remained on dry ground. He connected them to toll lines to Abilene and Salina, and rowed the townspeople, in his rubber boat, to and from the telephones to answer emergency calls. Backbreaking work! But he also found time to direct the Red Cross in dropping bundles of food to the marooned citizens.

In Miami, Oklahoma, Andy Anderson, a former employe, did the same sort of ferrying job. There were three Topeka plant men, Joe Murrell, Gene Swanson and D. D. Proctor, who found themselves blocked from a trouble call by the raging water. They turned-to and helped the Red Cross until they were able to get back to their telephone duties. Time does not permit me to mention the names of many others. But there are scores.

From all over the Bell System, people and supplies have poured into the stricken area. One hundred and thirty-two Long Distance operators were flown into the flood area from New York, Louisville and Chicago. One thousand six hundred telephone workers from eight states are on the scene. They work beside thousands of citizens in the muddy job of mopping up. Before telephone service can be restored, thousands of connections must be cleaned and dried. Great quantities of equipment have to be replaced. In some towns, new telephone offices must be built.

No job, however, is too tough nor too mean for the skilled and willing hands of telephone people. Theirs is the great tradition of service. Whenever and wherever disaster strikes, you'll find them—trained, equipped, and ready to meet the challenge—backed up by the full resources of the Bell Telephone System.

Radio Relay—The Newest Means of Transcontinental Telephony

THIRTY-SIX YEARS AGO, words first sped on wires from New York across this country directly to San Francisco. The East Coast and the West were united telephonically when service was opened on January 25, 1915.

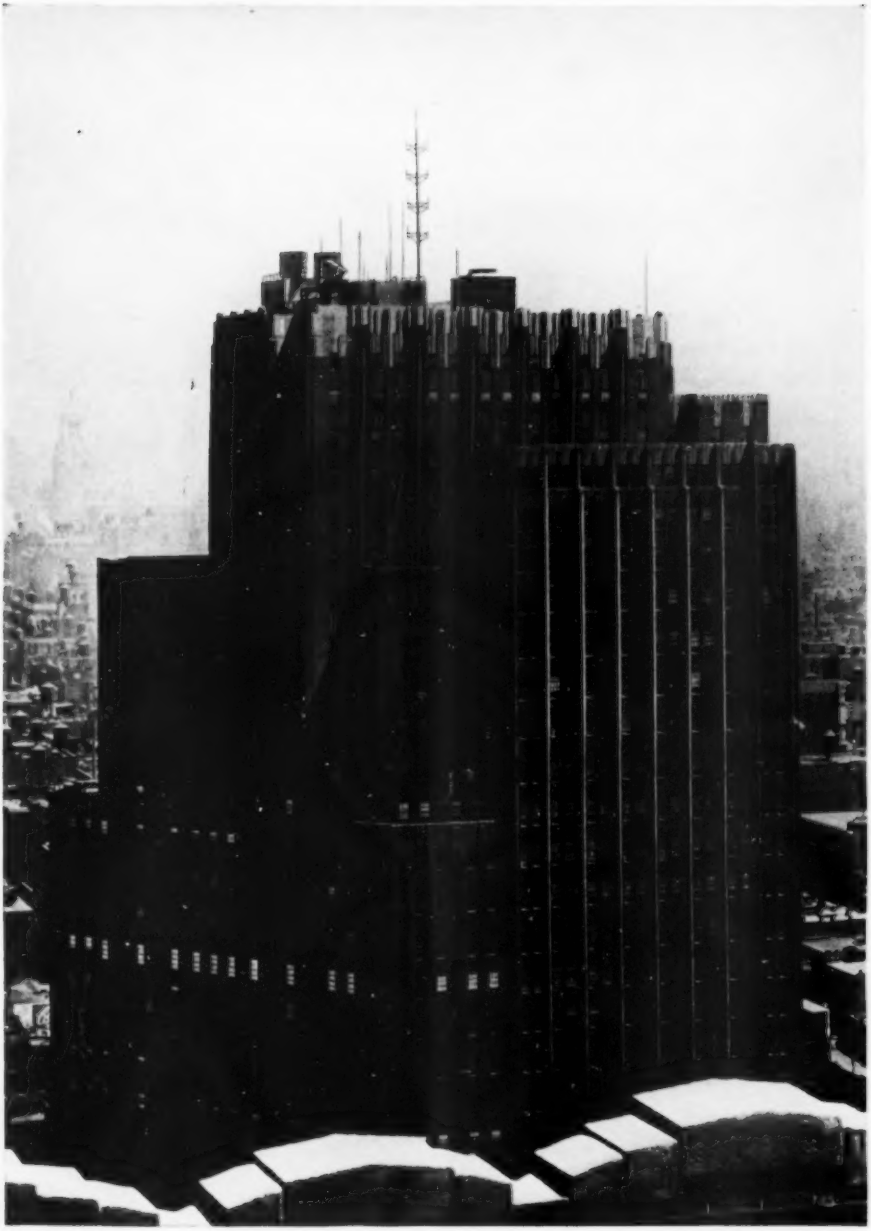
Words made the same journey last August 17 *without wires,* when commercial telephone service was inaugurated over the new transcontinental micro-wave radio relay system, which utilizes 107 relay towers in covering the nearly 3,000 miles between the two cities.

Radio relay channels can be used to transmit television images as well as conversations, and the system was first used for TV program transmission on September 4, when facilities were provided temporarily, at the request of the State Department, to permit transcontinental telecasting of President Truman's opening address to the Japanese Peace Treaty Conference in San Francisco and several of the succeeding sessions. Regular coast-to-coast service in both directions was provided by the end of the month.

The new system brings to seven the number of telephone routes which cross the continent. Four consist principally of open wire, one of coaxial cable, one of twin carrier-current cables, and now one of radio relay. The seven routes spread from Montana to the Mexican border, but all are variously interconnected, and their number and variety are important factors in the country's defense program.

Radio relay has been discussed previously in this MAGAZINE,* and is interestingly described on pages 170–173 of Dr. Buckley's contribution to this issue. The pictures on the next dozen pages, showing radio relay towers in many locations from the Atlantic to the Pacific, may stir the reader's imagination to ponder the inventing and designing, the manufacturing and installing, the engineering and testing and building which preceded the opening of this $40,000,000 telephone route to the service of the American people.

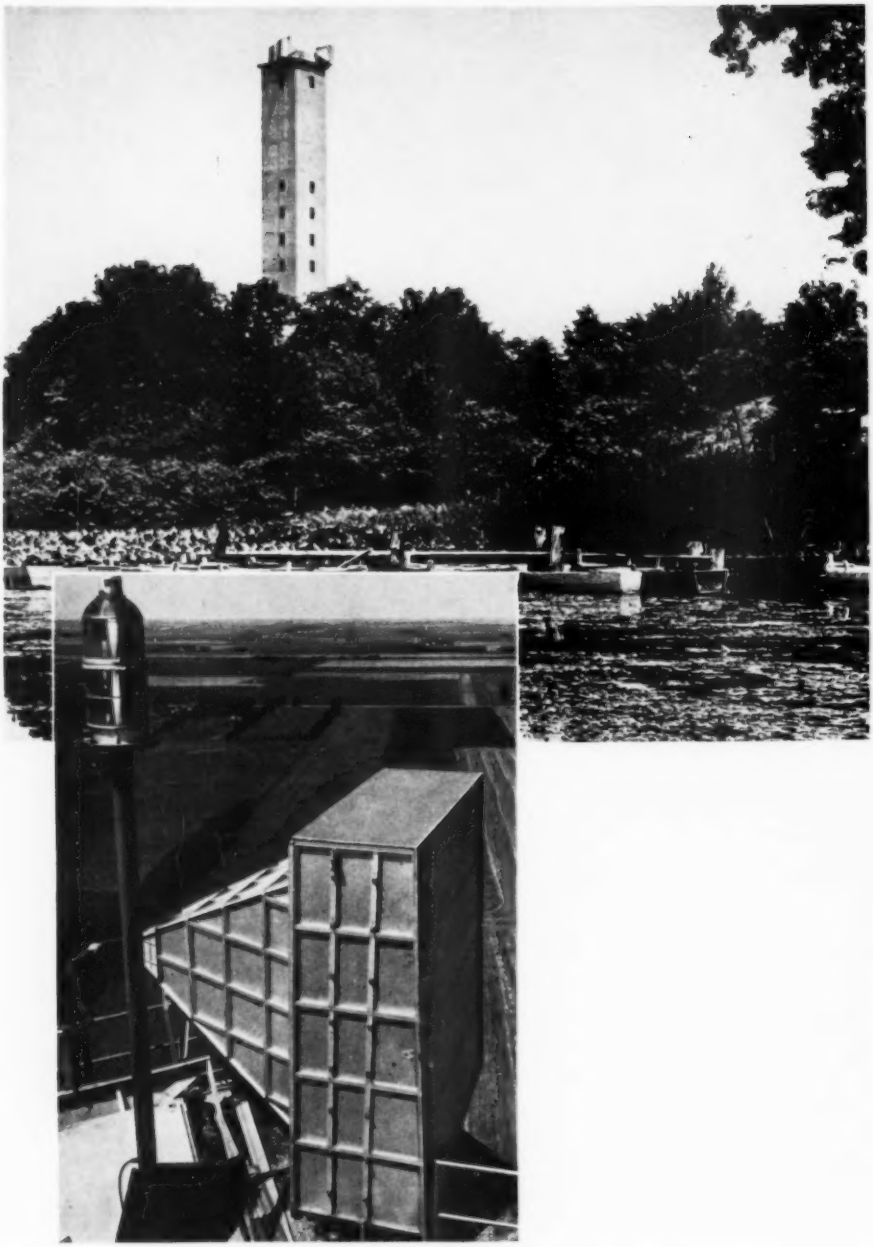
* See "Radio Relay and Other Special Buildings," MAGAZINE, Spring, 1950, and "Spanning the Continent by Radio Relay," MAGAZINE, Winter 1950–51.



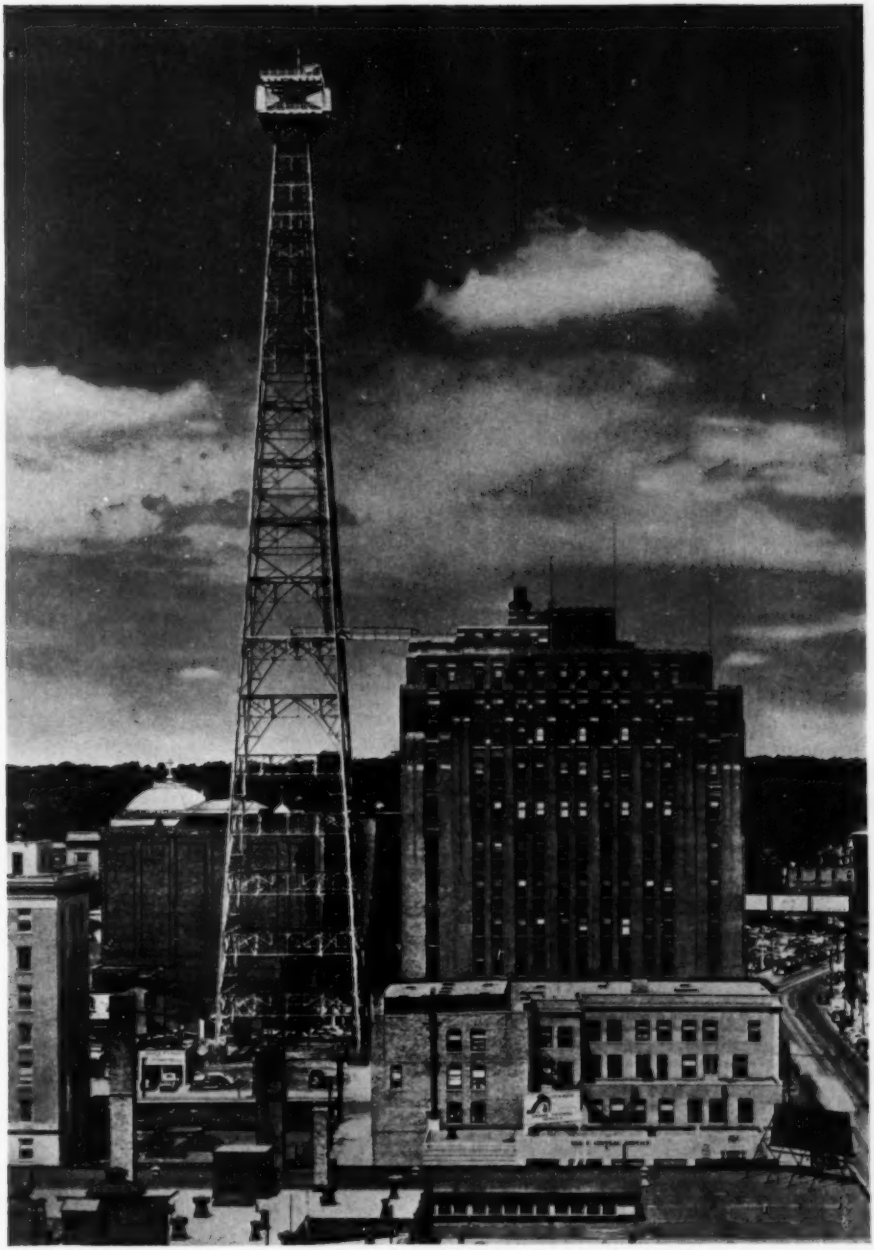
Westward-pointing antennas atop the Long Lines headquarters building in New York mark the eastern end of the new radio relay system

Solid amid the rich fields of the Plain People of Pennsylvania stands a radio relay tower. Of its four square metal-lens antennas, two facing East and two West, one in each direction is to transmit and the other to receive the radio signal

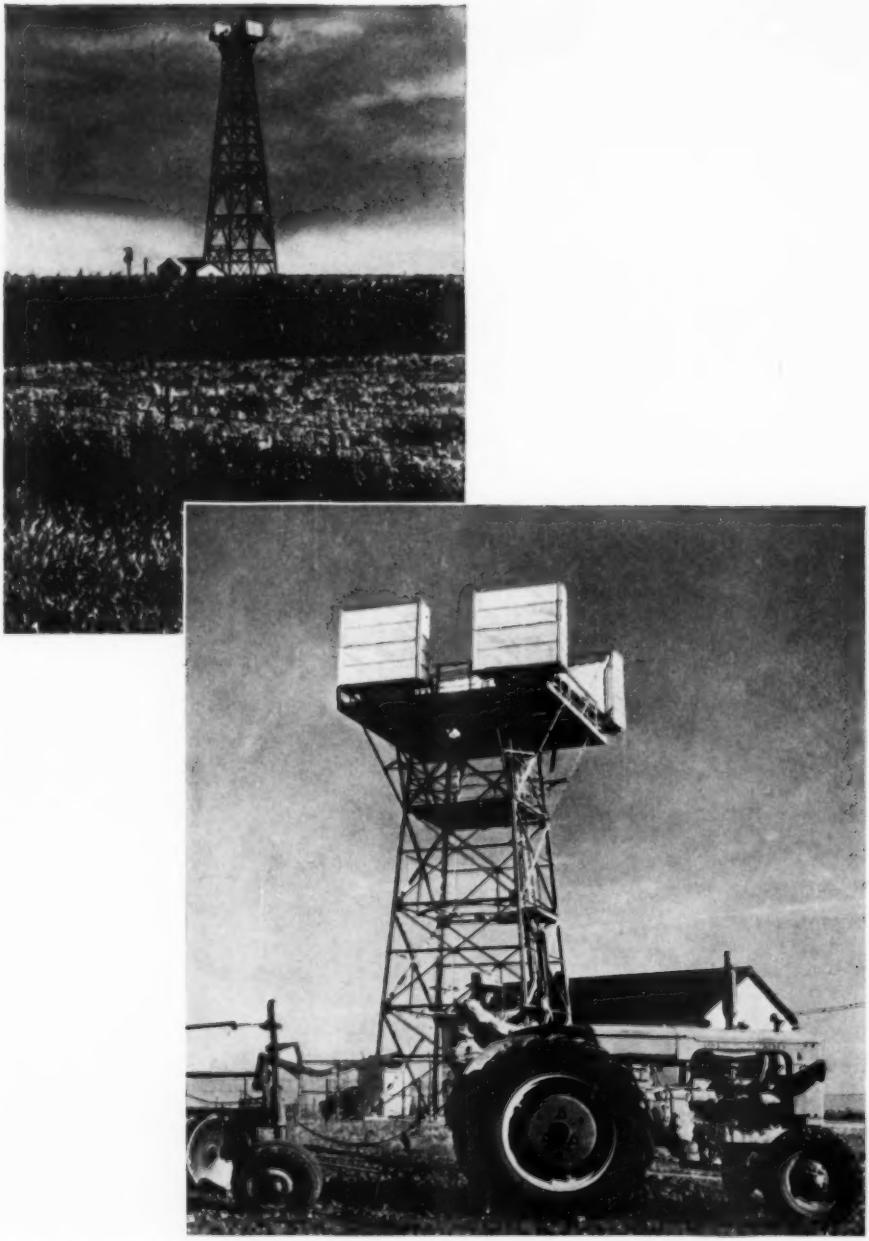
This tower looks out upon the enfolding ridges and the densely forested wilderness of the Allegheny Mountains



The peaceful countryside of Indiana and the cultivated plains of Illinois are spanned by the radio beams which flash from tower to tower



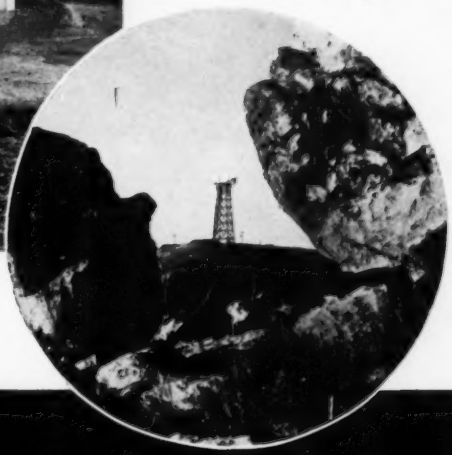
Tallest of them all! It's 427 feet from the ground to the top of the antennas on this tower, which stands beside the telephone building in Des Moines



The flat and fertile farm lands of the West—of Iowa and Eastern Colorado—have new eye-catchers to see against the horizon

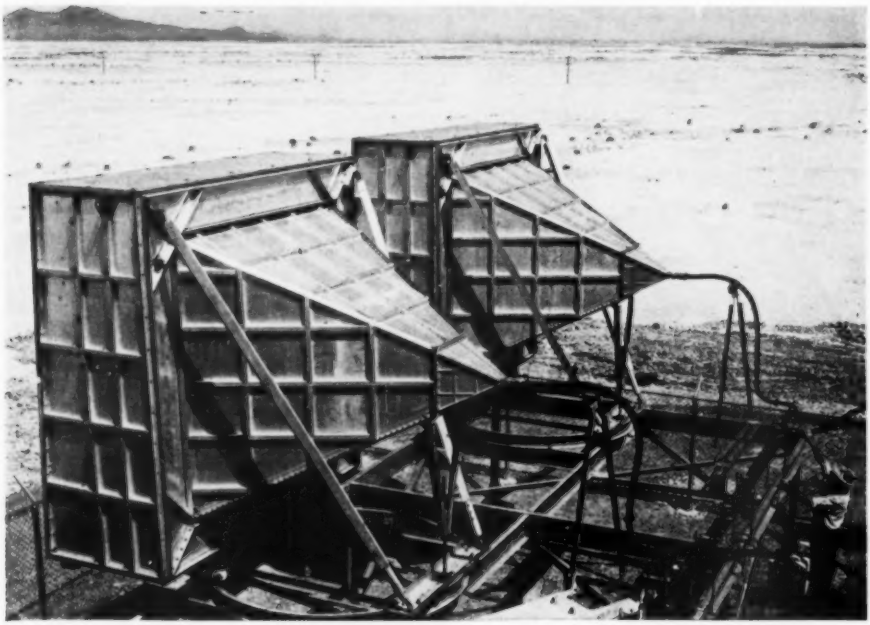
The requirements of line-of-sight transmission account for the two levels of the antennas here

Rugged terrain!



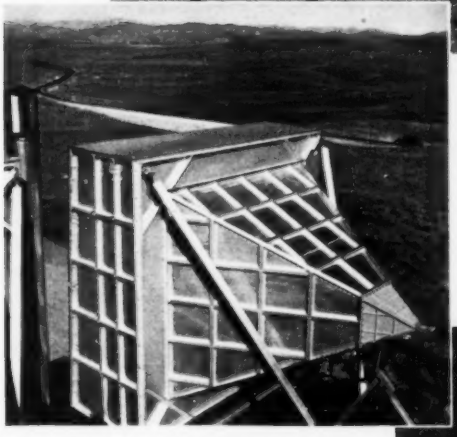
Not all towers are as readily accessible. Road building to remote and often mountainous locations was a big item of construction

The radio relay tower appears behind the left wing of the monument. Designed by Mahonri Young, grandson of Brigham Young, this handsome feature of a barren landscape marks the spot in Salt Lake valley indicated by the Mormon leader when he declared to his home-seeking followers, on January 24, 1847, "This is the place"



The salt flats of Utah presented special problems to the transmission engineers

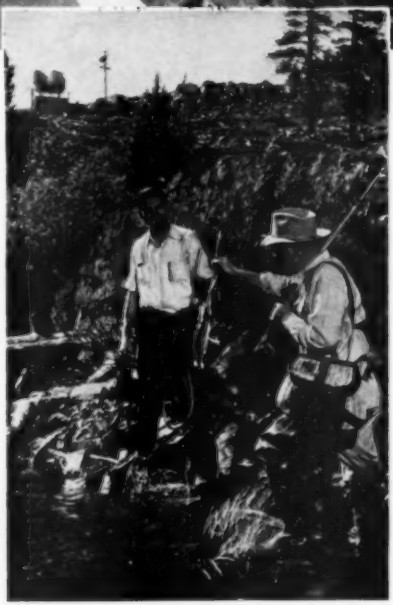
The tower itself need not be high if the hill is high enough



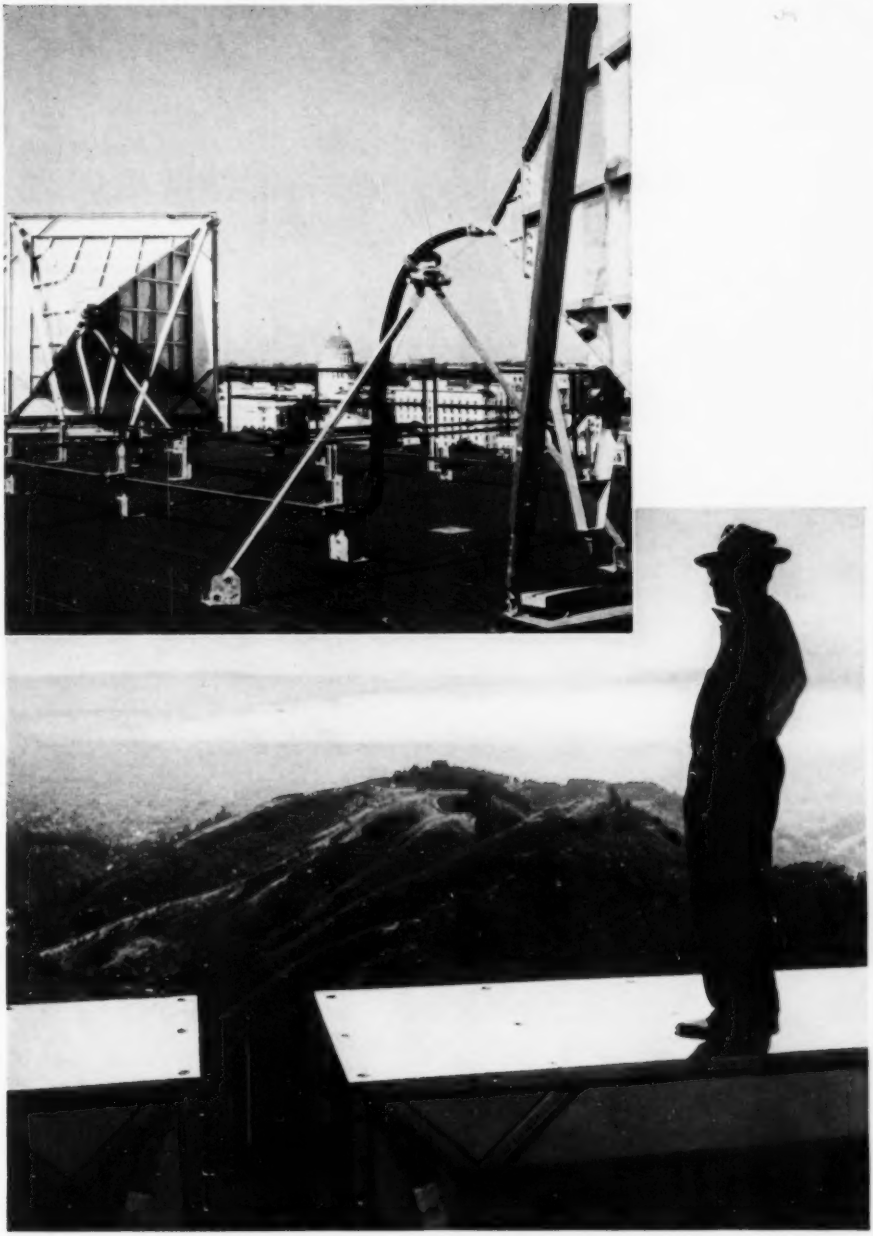
Across the Great Plains the road goes on and on

Radio relay tower and CAA airplane beacon make use of the same advantageous location

This is Mt. Rose, Nev., and the antennas are more than 10,000 feet above sea level

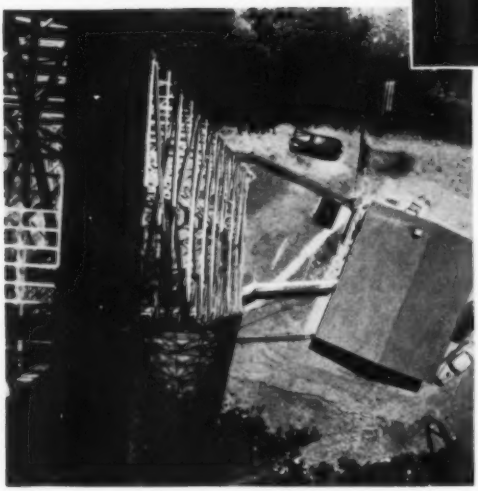


Radio relay towers interfere not a bit with enjoyment of life in the open. These pictures were taken in Nevada (left) and California



Above: The golden dome of California's Capitol at Sacramento appears in the distance. Below: Looking westward from the radio relay tower at East Bay Hills, Cal. Across the bay lies the Golden Gate

Here is some of the equipment which speeds the radio signals on their way, with the speed of light, from tower to tower of the transcontinental system



You're looking 200 feet straight down

End of the line! Antennas on the headquarters building of the Pacific Telephone and Telegraph Company in San Francisco

The Bell System's Long-Established Policy of Conserving And Re-using Telephone Equipment Has National Significance In This Period of Scarcity of Materials

Conservation of Materials

C. C. Duncan

ON ROBERT'S MOUNTAIN in Oregon, lineman Rodney Peterson and his gang are taking down the "Old South Lead." Built in 1898—when Oregon was young and rugged—this bare copper wire line has carried long distance calls which were part of the expansion and struggles of a growing nation for over 50 years. Now it has given way to a storm-proof underground coaxial cable. While the line is old and obsolete, the hardware, crossarms, and poles that are in good condition will be re-used and will help to provide vital telephone service at other locations for the nation which still struggles and still grows. These materials will be carefully saved and re-used in their present form in the construction and maintenance of other open-wire lines.

But the nation and the telephone industry are short of copper—copper for defense, and copper for telephone equipment and cables. The copper wire from the "Old South Lead" is being rushed by truck to freight cars, sent by expedited shipments across the country to Staten Island in New York Harbor, where it is smelted in the Bell System's Nassau refinery and then rushed to the Western Electric Works at Point Breeze, Md., Kearny, N. J., and Hawthorne, Ill. It is there converted into wire, parts for telephones, coaxial cables, radio relay systems, exchange cables, and equipment to meet the insatiable demand of the country for more and more telephone service.

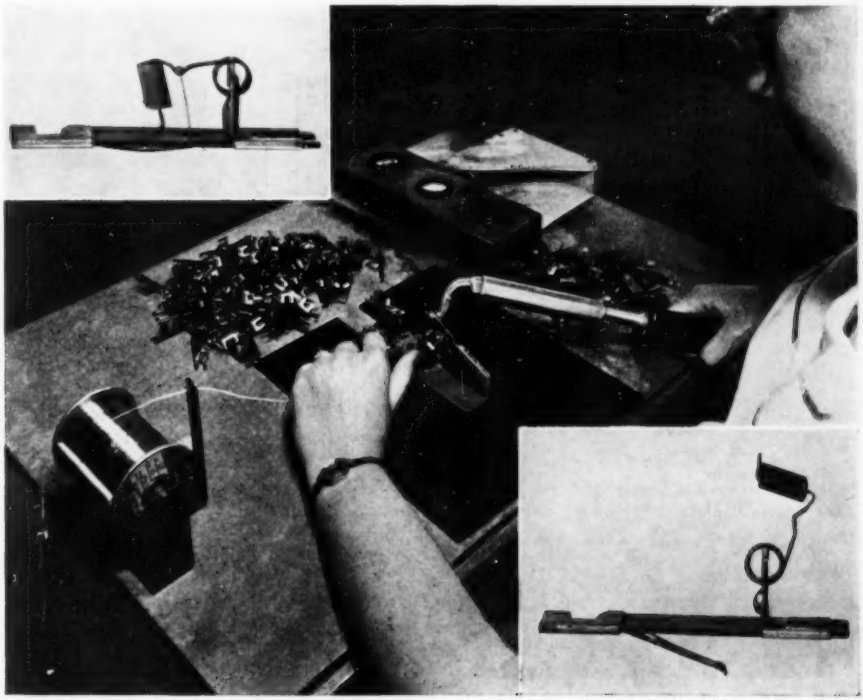
Rodney Peterson is doing his part to supply copper and other critical materials for the needs of the nation —and the telephone industry. Many others are also doing their share—some in conservation and re-use of large amounts of material, others of small. Regardless of how small the individual amount is, the cumulative effect of the savings of all of the people in the Bell System is tremendous.

Let's take a look at a few of these people.

IN THE WESTERN ELECTRIC repair shop in the distributing house at Indianapolis, Marjorie Grimes carefully puts a thin piece of low-melting-

point wire in a blown "grasshopper" fuse to replace its burnt-out fusible link. Millions of these fuses are used in central offices to protect telephone equipment against damage and fire from abnormal electrical currents. They consist of a small piece of fusible wire and a spring mechanism which sounds an alarm and gives a visual indication when the fuse operates. The fusible wire is the only part of the fuse that was used up when it operated. By replacing this tiny piece of wire, she saves the materials and work of making an entirely new fuse.

IN THE GLENVILLE EXCHANGE in Cleveland, Ken Carlson is coiling up short lengths of re-usable insulated frame wire. Miles of wire are used in the distributing frame in his large central office to connect the cable pairs and the central office equipment together. Additional subscribers, number changes, subscriber moves, and cable and equipment rearrangements require these wires on the distributing frame to be connected to different terminals. Often the old wire is too short to reach and has to be replaced with a longer piece. These short lengths are carefully saved and used over again, either in the same office or in smaller neighboring offices.



Skilled hands now repair "grasshopper" fuses. A blown fuse, at lower right, is shown restored to usefulness at upper left

These short lengths of distributing-frame wire are saved for re-use

THE MOTOR VEHICLE SUPERVISOR at Detroit is putting a new driver through a series of demonstrations to show him, by actual measurement, the difference in amount of gasoline used over a nine-mile course when proper driving methods are used. The 55,000 cars in the Bell System use 170,000 gallons of gasoline daily, and a little saved by each car adds up to a lot of gasoline conservation.

A NEW SECTION of switchboard is needed for Curwensville, Pa. Before ordering it from the factory, a check is made in the central records file in New York, where a record is kept of the surplus equipment throughout the Bell System. This check shows that a surplus switchboard section of the type needed is available at Oceanside, Cal. While it was not the proper type of board for Oceanside, it had been used there as a temporary expedient to take care of peak loads at the Camp Pendleton Marine Base during World War II, and had subsequently been replaced. Since it can no longer be used at Oceanside, it is sent to Curwensville, thereby saving the materials and work required to build a new section of switchboard.

The Central Records Plan for disposal of surplus supplies, equipment, tools, and motor vehicles among Bell System Companies has been in operation almost ten years. During this period, several million dollars' worth of materials has changed hands. The plan enables the Associated Companies to obtain items which they require and to dispose of surplus among themselves.

The Companies report their surpluses periodically to the Western

This switchboard section journeyed nearly across the country to render service again

Electric Company, which acts as an intermediary to bring them together, although the actual purchase and sale is consummated between the telephone companies concerned. Started in 1942 as a war conservation measure, it has become a permanent Bell System procedure for conserving supplies.

A STENOGRAPHER in Springfield writes a letter on both sides of a sheet of paper; an engineer in Dallas uses the back of superseded blueprints for scratch paper; a clerk in Cincinnati is careful to run off on the mimeograph machine just the requested number of copies of a report; a house serviceman in New York collects waste paper for recovery, and an installer in Providence returns an empty cardboard carton to the warehouse for further use. All are easing the nation's paper shortage.

AN INSTALLER in St. Louis removes a telephone set. It has been in service many years and shows the effects of long usage. Nevertheless, he carefully puts it in a carton and takes it back to the garage. The supply man packs it so that it won't be damaged in shipping, and sends it to the St. Louis Western Electric repair shop. There it is thoroughly tested and inspected, worn and defective parts are replaced, the set is cleaned and refinished and, as good as new, is put back into circulation for re-installation.

That's one more set that won't have to be manufactured by the Western Electric Company's new telephone instrument factory at Indianapolis, which is striving to build up production to meet the mounting demand for more and more telephones. A few more pounds of scarce materials are saved. But when multiplied by 300,000—the number of used telephone sets that are repaired and reused each month by the Bell System—it becomes a real conservation factor.

VETERAN P.B.X. installer John Kooistra at Grand Rapids is sharpening a drill. It is a long drill—used to drill holes through beams and in difficult places. It was 18 inches long when it was issued to John, 11 years ago, and he has been using it almost daily since then. When it got dull, John sharpened it. He did it right, using tools to hold the drill at the

Used telephones, skilfully repaired, will again become part of the working telephone plant. Worn-out cords, at right, will go back to the smelter for copper salvage

proper angle. Each time it was sharpened, a little of the metal was removed—so now the drill is four inches shorter than it originally was. But it's still in good condition after 11 years of use and John proudly states that he will still be using this bit when he retires this fall. He is one of many telephone men who know that "if you take care of tools properly they will give long service."

A SUPPLY MAN in Baltimore is studying the inventory and usage of supplies, to determine the least amount of supplies to be carried on trucks and in the storerooms and still have enough on hand when needed.

The 44,000 maintenance and construction trucks in the Bell System are equipped with the supplies that are needed every day by the maintenance and construction men. Installation trucks have telephone sets, wire, and all of the numerous pieces of mateterial needed for installation of telephones. Construction trucks carry cable sleeves, solder, hardware, etc., for building telephone plant. Each truck has to have enough on hand to meet the requirements. But a little too much on each truck would add up to a large quantity when multiplied by all of the trucks in the Bell System—so the supply man is constantly reviewing the requirements to keep these stocks at a minimum.

He knows that many of the telephone supplies are made of critical materials which are needed for defense and that any reduction he can make in the stocks on hand will be reflected in reduced demands on the factories for new materials.

THE CROSS-ARM on the pole line in Colorado has been in service many years. While it is still strong and able to carry its load of wires, it has started to split from the effects of rain and sun, and the end insulator pins are loose and starting to come out. In past years this meant replacing the cross-arm with a new one—but then someone thought of pulling the split together and fastening it with a steel band. So, the section lineman is banding the cross-arm, making it last many more years, saving the time required to replace the cross-arm and transfer the wires and saving the wood that would have been required for a new arm.

Sharpening a drill he has used for 11 years

SHORT ENDS—pieces of new insulated drop wire left over in the reel, other pieces of used

wire still in good condition—all good wire but too short to reach from the pole to the house. These are rubber-insulated twin copper-coated steel wires with a heavy neoprene jacket, and are not easy to splice properly. But some way had to be found to use these short pieces. So a special splicing machine was developed which securely fastens the conductors together and then by heat and pressure forms a plastic insulating covering over the completed splice. Now 3,000,000 feet of short ends of drop wire are spliced together each month in the Western Electric repair shops, saving 130,000 pounds of material in this one conservation operation.

Placing a metal band tightly around the end of a cross-arm postpones—perhaps for years—the need for a new arm and for transferring the wires

AN ENGINEER in Philadelphia studies the exchange cable layout to get the maximum usage from existing cable pairs so as to defer installation of new cables. He has to be sure that cable pairs are available when needed for new telephone service—and also that these cable pairs are not idle for long after they are constructed. The proper balance between too much and too little cable plant is always with him, but the critical copper shortage has accentuated it now. When new telephone cables are required, he specifies the smallest gauge of wire possible for satisfactory transmission, in order to stretch the short supply of copper as far as he can. He gives thanks to the Bell Laboratories' people who developed the new "500 type" telephone set, which has the increased efficiency to enable him to "stretch" his copper into thinner conductors than he could use before.

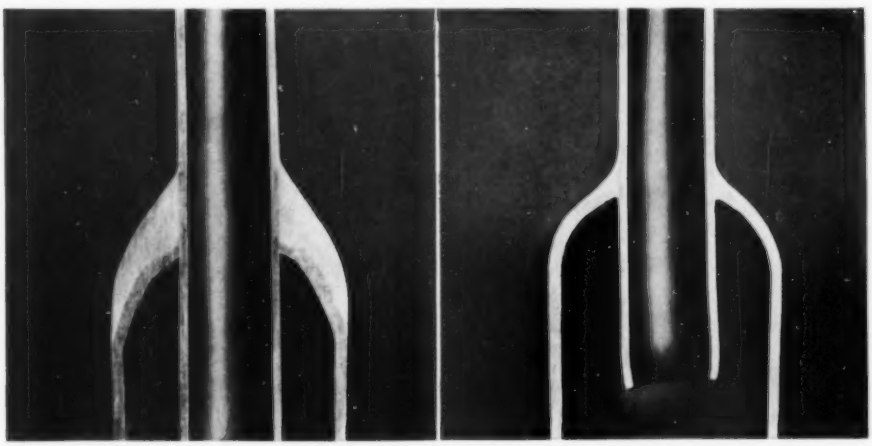
THE COMPANY CAR has been "loping" a bit, so when the installer brings it into the garage that evening he reports this to the garage mechanic. The mechanic loosens up the valve that is starting to stick, and the car

Splicing short pieces of drop wire together makes usable lengths—and saves tons of material into the bargain

is back to normal—thereby avoiding the replacement of a valve made of steel which is critically short.

THE SPLICER is sealing a joint in the telephone cable with hot solder. He started working for the Telephone Company in 1946, after returning from World War II, and this is the way he was taught to wipe a cable joint. It doesn't seem unusual to him, but the old-timers could tell him that it is a special type of splice, called the "Victory Joint," which helped to conserve tin to win that war.

Before then, the joints at the ends of the cable sleeves were wiped in a rounded, ball-like shape and used a lot of solder. When tin became scarce, in 1942, a new technique was developed which used only a small fillet of solder at the edge of the sleeve. It saved about 110,000 pounds of tin yearly during the war —and several times that amount after the war. Just because the war

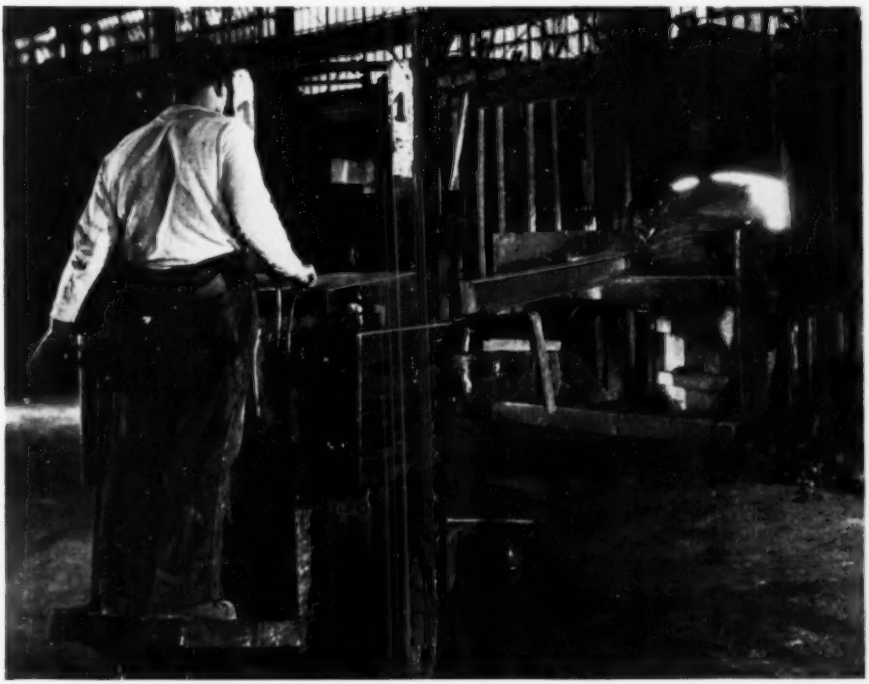


The old fat soldered cable-sheath joint—shown in cross-section—gave way to the sleek "Victory" joint at the right—and tons of scarce metals are saved every year

was over and tin again became available was no reason for dropping a good method—so the "Victory Joint" is the only kind the new splicer knows how to make—and the Bell System continues to save over 400,000 pounds of tin a year.

DURING the day, the installer in Knoxville has been saving the ends of wire, clamps, and hardware that he has removed, and dropping them into his material bag. The cable splicer in Albany has an old lead sleeve and some small pieces of cable sheath. The equipment maintenance man in Wright City has replaced three worn-out vacuum tubes. The teletypewriter repairman at El Paso has a few broken and worn parts. The mechanic in the Hawthorne factory has gathered up some brass cuttings.

All over the country, telephone people are recovering and collecting these pieces of scrap. Most of them are so little that they seem insignificant—except that they shouldn't be left to litter up the Company's or customer's premises. But these hundreds of thousands of little trickles of scrap help to make up the flood—350,000 pounds per day—that flows into the Western Electric Company's scrap recovery plant on Staten Island, the Nassau Smelting and Refining



Junked copper line wire goes into a smelter in the Western Electric Company's recovery plant, and will find its way again into the manufacture of telephone equipment

Company. In this plant, experts sort out and reclaim all of the re-usable materials in the scrap returned. It is fed into furnaces and refined into basic metals for making new telephone equipment.

It is a real help. About one-seventh of the copper used by Western Electric's factories in 1950, 35,000,000 pounds of lead and approximately 100,000 pounds of nickel and nickel alloys, came from Nassau. Added to this, almost 2,250,000 pounds of nickel and nickel alloys were recovered from cuttings and filings at the factories, and 780,000 pounds of aluminum and 41,000,000 pounds of iron and steel were pumped back into the raw material market under Nassau-established contracts with local smelters—all of which came out of the flood of scrap sent in by people all over the Bell System.

A GROUP OF ENGINEERS from the American Telephone and Telegraph Company, Western Electric Company, and Bell Laboratories are working on substitutions for nickel, which has become very scarce because of defense demands. They will solve this problem, as they have solved many others. Typical examples of annual savings already made are: 2,400,000 pounds of copper by substitution of aluminum for drop wire clamps; 23,000 pounds of tin foil in capacitors released by aluminum; 250,000 pounds of aluminum in telephone dials by substitution of steel. Many other substitutions are on their way to ease the shortages of critical metals, and to insure that the flow of equipment needed for telephone service goes on.

This is an example of the coördinated work that is being done in the Bell System to provide economical telephone service for the nation with the minimum usage of critical materials.

ALL OF THESE PEOPLE and many more throughout the Bell System are doing their part to answer the nation's vital need for conservation of scarce materials. But they didn't just start doing it when the present emergency developed. Repair and re-use of telephone equipment and salvaging materials is a normal way of life in the Bell System. While the pace quickens and the direction changes somewhat in times of shortages and national emergencies, the methods and practices have been developed over many years and are continually being followed. They are a real contribution toward reducing the demand for critical materials and manufacturing facilities and for providing good telephone service at the lowest possible cost.

The Bell System is one of the largest users of materials in the country, and it is fitting that all Bell System people should always be on their toes to conserve this material and get the maximum benefit from it—whether in peace or war.

Half a Century Ago the Telephone Bore to Vice President Theodore Roosevelt the News of His Succession to the Highest Office in the Land

TR Receives His Summons To the Presidency

Richmond B. Williams

Author and editor are indebted to Mr. Hermann Hagedorn, Secretary of the Theodore Roosevelt Memorial Association, in New York City, for his assistance in providing material used in the following article. Mr. Hagedorn, a biographer, was a friend of the late president.

THIS 75TH ANNIVERSARY YEAR of the telephone is also the 50th anniversary of the assassination of President William McKinley and the succession of Theodore Roosevelt as 26th President of the United States. There is much more than a coincidence of anniversaries to link these events, however. For the telephone, then still in an early stage of development, carried what may have been its most important messages up to that time in summoning the Vice President hurriedly to assume leadership of the nation.

For TR, as he was nicknamed, a difficult and historic week was ushered in on September 6, 1901, by a long distance telephone call.

So stated today, nothing could seem a more normal and casual occurrence. But it was not thus in 1901. Then there were only about 1,762,000 telephones in the United States,* of which more than a million belonged to the Bell System. The average number of toll connections handled in a day then was only about three-fourths as many as those transmitted at present in an hour. Moreover, if the connection was very long, an operator or two might have to come in on the line to help relay the conversation. Telephones were still rather a novelty, and obviously a long distance call on that September day just half a century ago did not relate to trivialities.

The chain of events began when the Vice President, a sportsman and robust outdoorsman, was attending the annual outing of the Vermont Fish and Game League, held on the

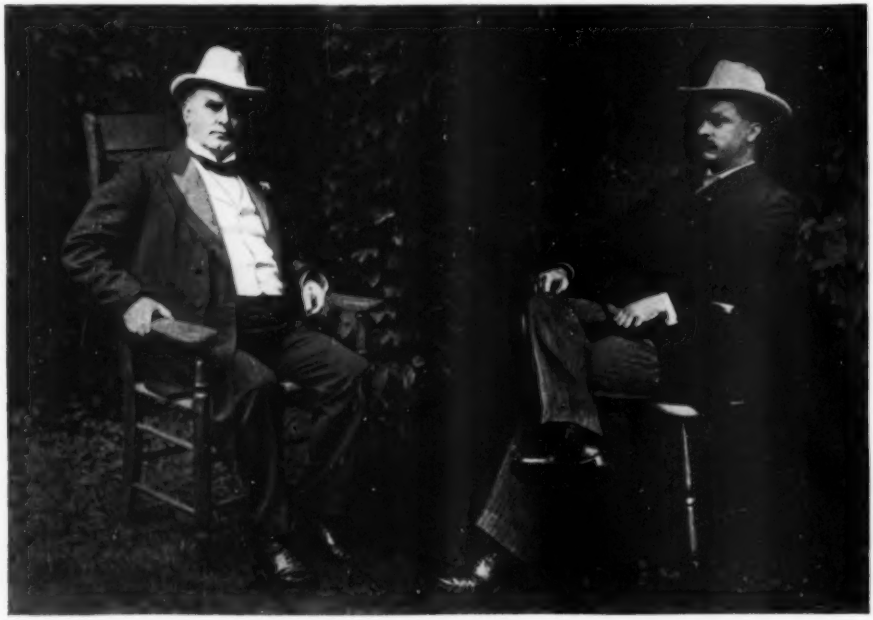
* More than 43 million today.

lawn of the residence of a former lieutenant governor of the State, at Isle la Motte in Lake Champlain. TR had made an informal talk after the meal, and the outing was over except for a general reception in his honor.

At that moment the host, Nelson W. Fisk, who had been called into his house to take a telephone call, hunted up Senator Redfield Proctor and the two men held a whispered conversation. Then Fisk drew Roosevelt into the library. Here he revealed to him that the wife of J. C. Butler, general manager of the New England Telephone Company in Burlington, some miles to the south, had called to say a story was coming in over the wires that, while opening the Pan-American Exposition in Buffalo, N. Y., President McKinley had been shot by a fanatic. Both Fisk and Proctor had decided that Roosevelt must be given the news at once.

When the initial reports were confirmed by another telephone call, Roosevelt, laboring under emotion, asked Proctor to inform the crowd waiting for him on the lawn. He then dictated a telegram and waited for further news. When it was learned that McKinley's wound was not necessarily fatal, Roosevelt hurried to the veranda and made the reassuring announcement himself.

The return to Burlington was made aboard the yacht of Dr. W. Seward Webb, a trustee of the Rutland Railroad. When the dock was reached, at 8:00 P.M., a special train was there to take Roosevelt and his party to



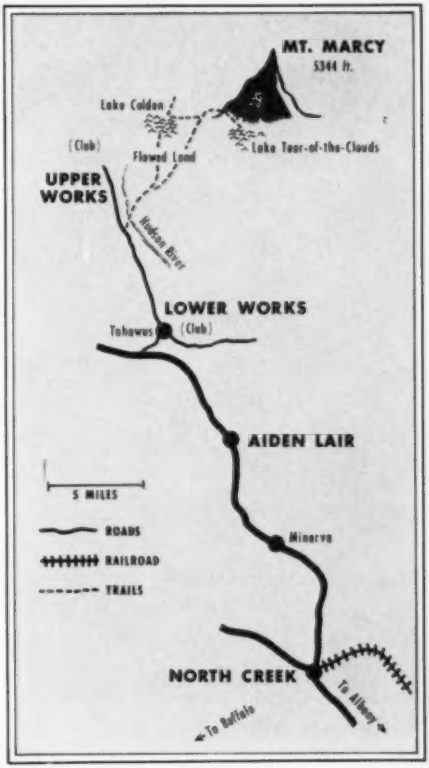
President William McKinley and Vice President Theodore Roosevelt sat for this picture in the fateful year 1901

Buffalo. At the dock, his friends, in person or by message, urged him, in view of the delicate situation, to avoid Buffalo and to go either to Washington or to his home on Long Island. However, as he later wrote in a letter, TR decided to do what seemed natural for him and to hope that it would turn out to be the right thing. He felt a genuine affection for McKinley and believed it more dignified for the second officer of the Government to learn of the President's condition directly.

In Buffalo the following day a haggard TR learned from the attending physician that the President's recovery seemed "almost as certain as anything human can be." But he accepted the invitation of a local lawyer to occupy his home rather than put up at the principal hotel, conferred with the members of the Cabinet, and remained near the President.

To the Adirondacks

AT THE END of three days, with McKinley's condition better hour by hour, Roosevelt left Buffalo to join his family, who were at a sportsman's club in the forests of the Adirondack Mountains in New York State. He arrived at the end of the railroad at North Creek on Wednesday, September 10, and drove twenty-five miles over rutted country roads in an open buckboard, arriving at the Tahawus Club drenched from a cloudburst. Mrs. Roosevelt had driven down to this point—now Tahawus but then called the Lower Works, since the buildings had originally served as offices for an iron mine—and the two then proceeded another ten miles farther into the mountains to club property at the so-called Upper Works.



The general Adirondack Mountain area in which the Roosevelts were vacationing in the early part of September, 1901

Here their children, a governess, and a maid, were established in a little two-story cottage on the banks of the Hudson River, which is just a small stream at that spot.

Roosevelt was happy to arrive, reported McKinley entirely out of danger, and proposed that they spend several days in the mountains. As the roads were uncertain after the storm, he suggested that they defer their departure until after the weekend. For one thing, he declared, he wanted to climb Mt. Marcy, the high-

The summit of Mt. Marcy as seen from Lake Tear-of-the-Clouds. It was here that Theodore Roosevelt received the summons to return to Buffalo without delay

est peak in New York State, which he had never mastered.

The Telephone in 1901

AT THAT PERIOD, the lines of the American Telephone and Telegraph Company extended along the Atlantic Coast from New England to Savannah, to Mobile on the Gulf, and to Little Rock beyond the Mississippi. They also reached many Great Lakes points, stretched westward to Omaha, and touched Lake Superior at Duluth. Since 1888 a long distance line had linked Buffalo, Utica, and Albany, extending not far distant from the southern edge of the Adirondack Mountain country. Further, since 1885 a telephone line had run from Albany to Saratoga Springs and Lake George, and a few small companies actually had lines into the mountains.

In the area in which the Roosevelts were then staying, the principal means of communication was by telegraph in to North Creek, the rail head. However, Louis (Lew) Pereau had connected North Creek with the Lower Works twenty-five miles away by a single-wire grounded telephone circuit, which also linked one telephone at the intermediate points of Minerva and Aiden Lair. Lew operated this service under the name of the North Creek Telephone Company, which later became the North Creek and Chestertown Telephone Company, predecessor to the present company, the Upstate Telephone Corporation.

Thus, TR was actually in one of the few primitive regions of the United States which at that time was not practically devoid of telephone communication.

Up Mt. Marcy

THE AFTERNOON after Roosevelt's arrival at the club, the whole party

set forth according to plan, leaving behind Quentin, aged four, with the maid, but taking two young Harvard law students and two guides. Just before they started, word had reached the Upper Works that the President was in "splendid" condition.

Anxiety thus relieved, the party tramped five miles up the trail toward Mt. Marcy to an area known as the Flowed Land and then went by canoe to the western end of Colden Lake, where the group occupied two cabins. After breakfast the following morning, the party divided: Mrs. Roosevelt, with the children, returning to the cottage at the Upper Works and TR, his host—the president of the Tahawus Club—and the two students and the guides taking the trail up the mountain.

The President's Condition Changes

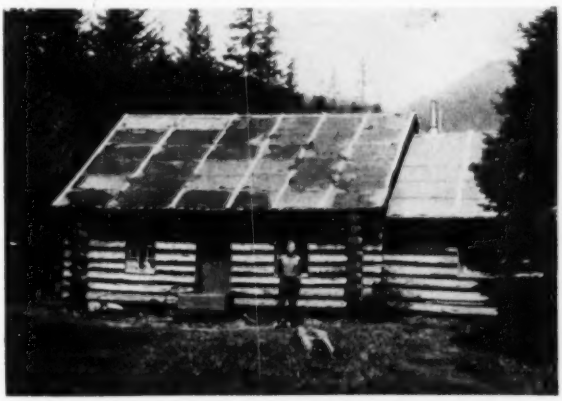
IN THE MEANTIME, in the middle of the morning down at the Upper Works, a team and buckboard spattered with mud dashed along side the clubhouse. The club superintendent went out to hail the driver and see what was up. When he returned, his face was grave and he held a telegram which had been telephoned from North Creek to the Lower Works. There it had been taken down by Mike Breen, who, with his wife, presided over the house on the mining property.

"Boys," he called to several guides before the fire, "there's bad news from the President. Somebody's got to carry a telegram to Mr. Roosevelt." An experienced woodsman named Harrison Hall was chosen for the task.

There had been a crisis in Buffalo in the night. The President had suffered what at first appeared to be a slight digestive disturbance but which developed into something serious. Elihu Root, Secretary of War, was called out of bed in his house up the street from where McKinley lay. Roosevelt must be summoned. Root telephoned the house of the lawyer who had been TR's host. Where was the Vice President and how could he be reached?

As we know, he could be reached by telegraph, telephone, and a husky mountain guide.

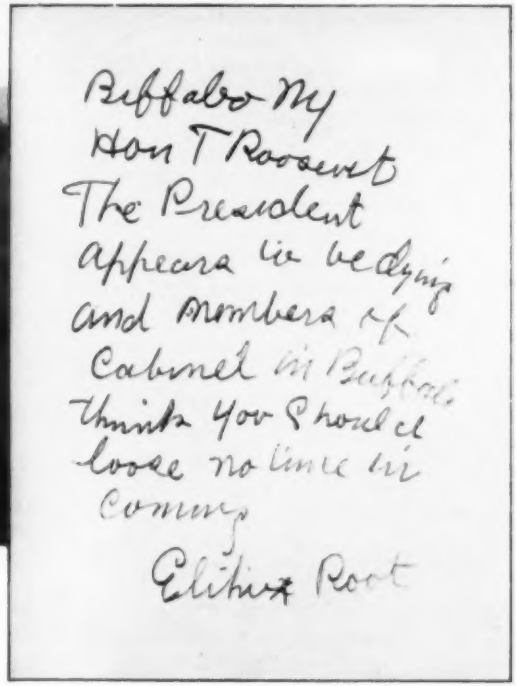
Shortly after the noon hour, Roosevelt and his party reached the summit of Mt. Marcy and found themselves on a rocky peak 5,344 feet above sea level, in clouds which broke occasionally to let them enjoy tantalizing vistas of blue ridges seen through the drifting mist. After a 20-minute stay, they descended a thousand feet to



Log cabin on the shore of Lake Colden

Above: Mike Breen, who accepted over the telephone and wrote down the series of historic messages addressed to Mr. Roosevelt

Below: The summons, in Mr. Breen's own handwriting


Buffalo N.Y.
Hon T Roosevelt
The President
appears to be dying
and members of
Cabinet in Buffalo
think you should
loose no time in
coming
Elihu Root

Lake Tear-of-the-Clouds, highest in the State, and at about 2:00 P.M. settled down to eat beside a little brook which is the ultimate source of the Hudson.

Suddenly the woodsman Hall appeared out of a thicket, coming toward them up the trail. Crossing the stream, he approached the Vice President and handed him a slip of paper.

Many years later, Roosevelt told a friend: "I was perfectly happy until I saw the runner some distance away. I had had a bully tramp and was looking forward to dinner with the interest only an appetite worked up in the woods gives you. When I saw the runner, I instinctively knew he had bad news, the worst news in the world."

Roosevelt took the paper, and drew away a little distance to read Root's message: "Buffalo, N. Y. Hon. T. Roosevelt. The President appears to be dying and members of cabinet in Buffalo think you should lose no time in coming. Elihu Root."

The Vice President stood in silence a moment, then told his companions what the note said, and announced that he must return to the club house.

Heading Back to Camp

AFTER hurriedly finishing the meal, the party started down the mountain. At the Flowed Land they divided,

Roosevelt proceeding to the Upper Works with one guide, and the rest returning to Camp Colden. When the Vice President joined Mrs. Roosevelt and the children at the house at 5:30 that afternoon, no further word had come from Buffalo.

Unless he was definitely and finally needed, TR told his wife, he was not going to Buffalo again but would wait there. However, he took the precaution of sending a messenger to the Lower Works, ten miles away, to arrange for relays of horses in case he should be called and to pick up any later messages.

As the late afternoon and evening wore on, Mike Breen continued to take down various messages telephoned from North Creek—from McKinley's secretary, George B. Cortelyou, who reported on the increasing gravity of the President's condition; from TR's private secretary, William Loeb, Jr., who reported that he was on the way from Albany with a special train; and from various newspaper men requesting permission to accompany Roosevelt to Buffalo.

In Buffalo, as hope for the President faded, the grief-stricken members of the Cabinet were filing into his bedroom to look on their chief for the last time. Soon the personal bodyguard of the President dashed through the rain to a press tent set up across the street and shouted to the telegraph operator: "Rush this to Roosevelt!"

The Ride Through the Night

BETWEEN ten and eleven that evening at the Tahawus Club at the Upper Works, there was a knock on the Roosevelts' door. It was the messenger, back from the Lower Works with reports of a telephone talk he had had with Loeb, the Vice President's secretary, who was at the North Creek railroad station. McKinley was in a coma and a telegram, delayed in transit, stated that it was imperative for the Vice President to come to Buffalo at once.

Roosevelt threw on his clothes and jumped into a waiting buckboard. The driver hurried him in total darkness down the rough and winding road, arriving at the Lower Works at 1:00 A.M. Here the Vice President telephoned Loeb in North Creek to say he was on his way.

The Adirondacks Stage Company had arranged for the necessary relays, and one of the surest drivers in the North Woods was ready with

Driver and team: Mike Cronin and the rig which carried Mr. Roosevelt on the last lap of the journey through the dark to the North Creek railroad station

fresh horses. Under ordinary circumstances the next lap, to Aiden Lair, nine miles away, was a somewhat better stretch of road. But a misty rain was falling and the driver, scarcely able to see the horses' heads, could only trust to his instinct to guide them as they sped along the rutted road. Roosevelt made no effort to converse with his driver on this wild ride but remained given up to his thoughts. At 3:15 A.M. the rig pulled into Aiden Lair, sixteen miles from the Delaware & Hudson terminus at North Creek.

Mike Cronin, keeper of the lodge there and a spirited Irishman in his middle thirties, had been watching the road for hours. Soon his black horses and surrey were dashing southward over the road they had known three or four times a week all summer. Except for an occasional query as to the distance remaining, and a word to urge that the speed be kept up, Roosevelt continued in silence. For him, it was a race with death.

Yet, curiously enough, the driver beside him knew that the race was already lost.

A telegram, received at North Creek, had been telephoned to him at Aiden Lair shortly before Roosevelt's arrival in the early hours of that September 14. It read: "Hon. Theodore Roosevelt, North Creek, N. Y. The President died at 2:15 this morning. John Hay, Secretary of State."

With his backwoodsman's independence, Cronin had taken it upon himself to decide when to deliver this momentous news. Why agitate Roosevelt unnecessarily during the hard journey? Why not wait until they reached North Creek? So he kept the news secret, determining what the mud-spattered but impressive figure beside him should and should not know.

As the sky was graying a few minutes after five o'clock, the foam-flecked horses drew up beside the waiting train at the North Creek railroad station. Loeb was there, and Cronin gave him the slip of paper with the telephoned message. The secretary passed it on to Roosevelt, who read it with tight lips. The paper fluttered to the platform but he bent down and picked it up, thrusting it into his pocket as he boarded the train for Buffalo—and the Presidency.

Who's Who & What's What

(*Continued from page 173*)

meeting ground. Mr. Williams joined the Long Lines Department in 1926, and has had various responsibilities since then—including that of Editor of *Long Lines Magazine*. During World War II he was a member of the House Magazine Advisory Committee of the War Finance Staff of the U. S. Treasury Department, and in 1943 was chairman of the Wartime Conference of the National Council of Industrial Editors' Association held in New York.

(The picture of McKinley and Roosevelt seated is used by courtesy of the Roosevelt Memorial Association. Mr. Welles was instrumental in obtaining from local residents a number of invaluable pictures and records, including the log cabin at Lake Colden, Mr. Cronin and his team, and Mr. Breen and the irreplaceable original copy in his own hand of the message from Root summoning Roosevelt to Buffalo. The picture of Mt. Marcy is from Gendreau.)

75 YEARS
OF SERVICE
TO THE NATION
1876
1951